MISSOURI STATE BOARD OF AGRICULTURE
1865

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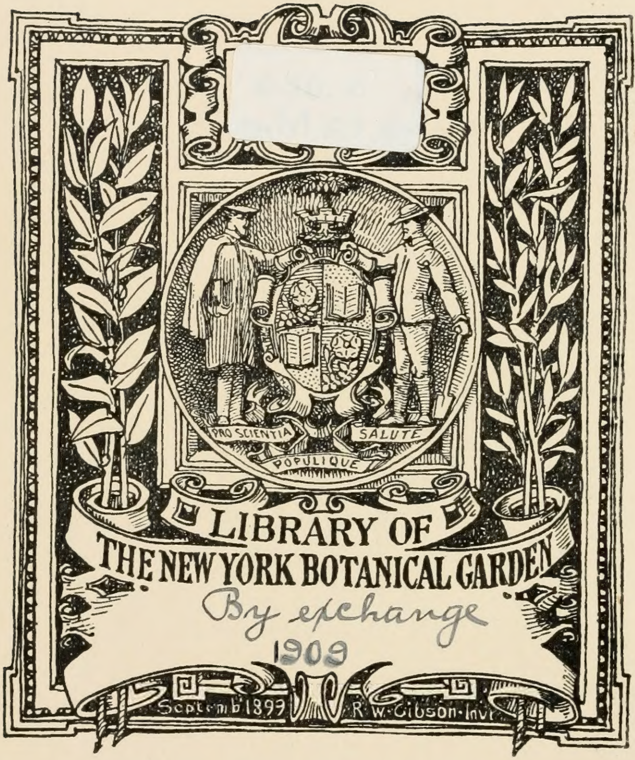

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Missouri State Board of Agriculture

COMPLIMENTS OF

Geo. B. Ellis

Secretary

FORTY-FIRST ANNUAL REPORT

OF THE

MISSOURI

State Board of Agriculture

A Record of the Work for the Year 1908.

ALSO VALUABLE INFORMATION ON BREEDING AND FEEDING LIVE-STOCK,
IMPROVING THE FERTILITY OF THE SOIL, GROWING CROPS,
DAIRYING, POULTRY-RAISING, ROAD-MAKING, HOME-
ECONOMICS AND THE IMPROVEMENT OF THE
FARM HOME, AGRICULTURAL AND
LIVE STOCK STATISTICS, ETC.

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OFFICERS OF THE STATE BOARD OF AGRICULTURE.

President—H. J. Waters, Columbia.
Vice-President—John Deerwester, Butler.
Secretary—Geo. B. Ellis, Columbia.
Assistant Secretary—W. L. Nelson, Columbia.
Institute Specialist—S. M. Jordan, Columbia.
Live Stock Assistant—F. G. King, Columbia.
Treasurer—W. A. Bright, Columbia.
State Veterinarian—Dr. D. F. Luckey, Columbia.
State Highway Engineer—Curtis Hill, Columbia.
State Apiary Inspector—M. E. Darby, Springfield.

EXECUTIVE COMMITTEE.

H. J. Waters, Columbia.
John Deerwester, Butler.
W. B. McRoberts, Canton.

EX-OFFICIO MEMBERS.

Governor of Missouri, Herbert S. Hadley.
Superintendent of Schools, H. A. Gass
Dean Agricultural College, H. J. Waters.

CORPORATE MEMBERS.

(Term expires July 20, 1909.)

Cong. dist.	Name.	Residence.	County.
1	W. B. McRoberts	Canton	Lewis.
4	John L. Christian	Rockport	Atchison.
7	N. H. Gentry	Sedalia	Pettis.
8	W. C. Howell	Ulman	Miller.
15	Sanford Mc. Smith	Reeds	Jasper

(Term expires July 20, 1910.)

Cong. dist.	Name.	Residence.	County.
6	John Deerwester	Butler	Bates.
9	J. W. Boles	Auxvasse	Callaway.
10	M. B. Greensfelder	Clayton	St. Louis.
11	Norman J. Colman	St. Louis	821 Holland Bldg.
12	W. R. Wilkinson	St. Louis	212 N. Main Street.

(Term expires July 20, 1911.)

Cong. dist.	Name.	Residence.	County.
2	W. C. Hutchison	Jamesport	Daviess.
3	A. M. Thompson	Nashua	Clay.
5	J. B. Sampson	Lee's Summit	Jackson.
13	E. E. Swink	Farmington	St. Francois.
14	R. A. Young	Alton	Howell.
16	A. T. Nelson	Lebanon	Laclede.

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President—W. R. Wilkinson, St. Louis.
Vice-President—R. A. Young, Alton.
Secretary—John T. Stinson, Sedalia.
Treasurer—C. W. McAninch, Sedalia.

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Norman J. Colman, St. Louis.
W. R. Wilkinson, St. Louis.
R. A. Young, Alton.
A. T. Nelson, Lebanon.
N. H. Gentry, Sedalia.
E. E. Swink, Farmington.
A. M. Thompson, Nashua.

STATE VETERINARIAN AND DEPUTIES.

D. F. Luckey, State Veterinarian	Columbia
Horace Bradley, Deputy State Veterinarian	Windsor
E. Brainerd, Deputy State Veterinarian	Memphis
W. F. Berry, Deputy State Veterinarian	Joplin
L. D. Brown, Deputy State Veterinarian	Hamilton
Henry Boettner, Deputy State Veterinarian	Perryville
L. G. Clark, Deputy State Veterinarian	Nevada
James Cullison, Deputy State Veterinarian	Charleston
A. C. Donohew, Deputy State Veterinarian	Boonville
E. M. Hendy, Deputy State Veterinarian	Jefferson City
R. B. Love, Deputy State Veterinarian	Springfield
J. H. McElroy, Deputy State Veterinarian	Grant City
R. C. Moore, Deputy State Veterinarian	Kansas City
R. J. Mitchell, Deputy State Veterinarian	Kirksville
A. J. Munn, Deputy State Veterinarian	Fayette
F. W. O'Brien, Deputy State Veterinarian	Hannibal
R. P. Poage, Deputy State Veterinarian	Shelbina
J. H. Slater, Deputy State Veterinarian	Richmond
Samuel Sheldon, Deputy State Veterinarian	Trenton
Stanley Smith, Deputy State Veterinarian	Columbia
J. G. Starr, Deputy State Veterinarian	Odessa
C. E. Steele, Deputy State Veterinarian	St. Joseph
T. E. White, Deputy State Veterinarian	Sedalia
H. H. Wolf, Deputy State Veterinarian	Maryville
W. B. Welch, Deputy State Veterinarian	Marshall
H. C. Tuck, Deputy State Veterinarian	Morrisville

ASSOCIATE ORGANIZATIONS.

IMPROVED LIVE STOCK BREEDERS' ASSOCIATION.

President—N. H. Gentry, Sedalia.
Vice-President—Hugh Whiteford, Guilford.
Vice-President—Paul Culver, Plattsburg.
Vice-President—R. M. Brown, Carrollton.
Vice-President—John R. Potts, Mexico.
Vice-President—Dr. G. M. Laughlin, Kirksville.
*Vice-President—H. R. Brasfield, Unionville.
Secretary-Treasurer—Geo. B. Ellis, Columbia.

MISSOURI CORN GROWERS' ASSOCIATION.

President—Frank M. Crowell, Butler.
Vice-President—Christ Ohlendorf, Boonville.
Vice-President—Elbert Thompson, Butler.
Vice-President—Elliott Tucker, Perryville.
Vice-President—Geo. H. Sly, Rockport.
Vice-President—E. L. Newlon, Lewistown.
Secretary-Treasurer—S. M. Jordan, Columbia.

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Vice-President—J. E. Roberts, Bolckow.
Vice President—W. S. Dille, Holden.
Secretary—F. L. Austin, Columbia.
Treasurer—D. A. Chapman, Warrensburg.

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Vice-President—C. B. Adams, Grandview.
Vice-President—W. S. Cotton, Smithton.
Secretary—C. A. Willson, Columbia.
Treasurer—W. E. Bradford, Columbia.

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*Deceased.

MISSOURI SHEEP BREEDERS' ASSOCIATION.

President—S. H. Groves, Tipton.
*Vice-President—H. R. Brasfield, Unionville.
Secretary-Treasurer—M. V. Carroll, Sedalia.

DIRECTORS SHEEP BREEDERS' ASSOCIATION.

John A. Rankin, Tarkio.
Harry Nance, Pattonsburg.
C. E. Bethards, Shelbyville.
S. C. Haseltine, Springfield.
W. W. Waltmire, Raymore.
D. Lee Shawhan, Lee's Summit.

MISSOURI HIGHWAY ENGINEERS' ASSOCIATION.

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Vice-President—E. B. Borron, County Engineer, Butler.
Secretary—Curtis Hill, Columbia.
Treasurer—P. S. Quinn, County Engineer, Columbia.

MISSOURI HOME-MAKERS' CONFERENCE.

President—Mrs. N. H. Gentry, Sedalia.
Vice-President—Dr. Edna D. Day, Columbia.
Secretary—Mrs. C. S. Blackmar, Columbia.
Treasurer—Miss Alice Kinney, New Franklin.

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*Deceased.

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LETTER OF TRANSMITTAL.

State Board of Agriculture, Office of the Secretary,
Columbia, Mo., March 20, 1909.

To Honorable Herbert S. Hadley, Governor of Missouri:

Sir—I have the honor to transmit to you a report of the work of the State Board of Agriculture for the year 1908, including the work of this office, and that of the State Veterinarian, State Highway Engineer, and State Apiary Inspector.

Trusting that the work of the Board and officers will prove to have been valuable in the development of the great resources of our State, and that the same may meet with your approval, I am,

Very respectfully,

Geo. B. Ellis, Secretary.

AUG 14 1909

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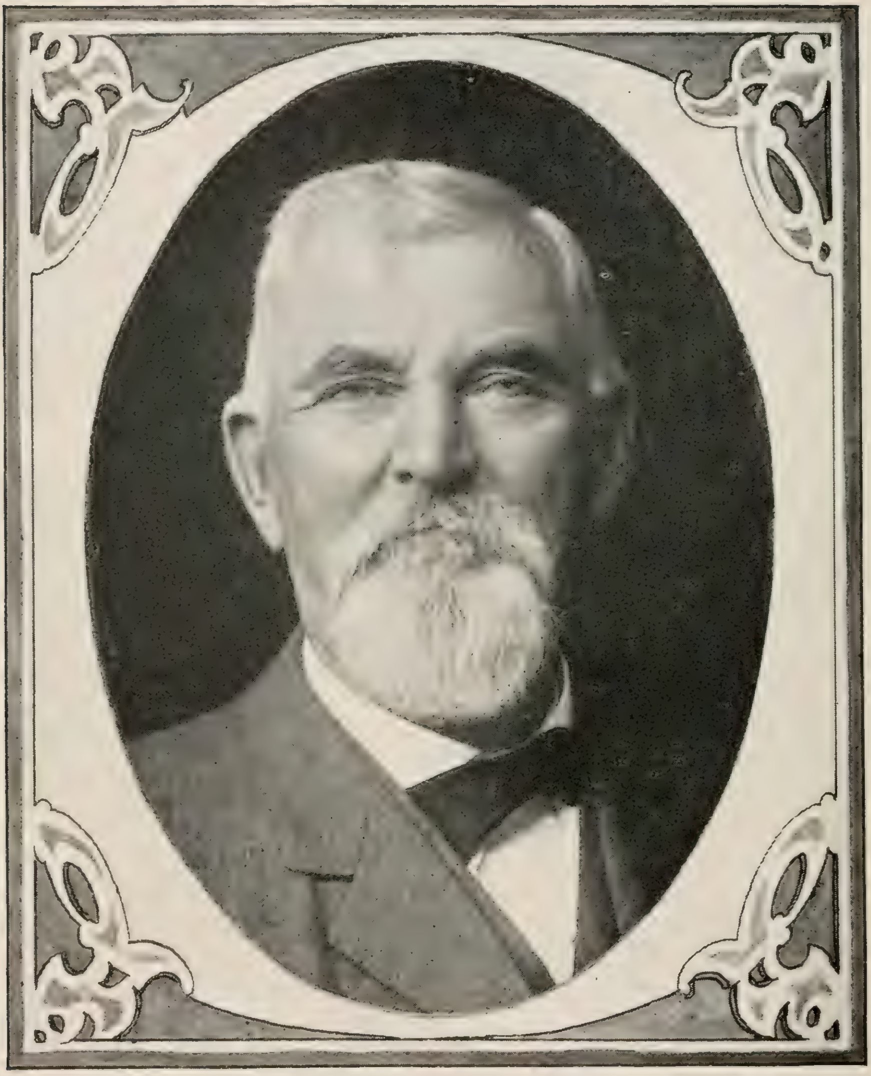


SAMUEL W. HUDSON

Born 1842. Died 1908.

SAMUEL W. HUDSON.

Born near Sibley, Jackson County, Missouri, March 2, 1842.

Honorable Samuel W. Hudson, the subject of this sketch, began a career of usefulness as a citizen of Missouri that is equaled by very few men. Mr. Hudson's father died while he was quite young, leaving the care of the family and the responsibility of managing a large farm upon him, which he very successfully accomplished. He entered Masonic College at Lexington in 1857, and William Jewell at Liberty in 1860. In 1862, at the age of twenty years, he joined the Confederate Army and was in the battle at Lone Jack and other engagements of the Civil War. In 1865 he crossed the plains from Omaha to Fort Bridges, Cal.

Married, in 1871, to Miss Mary Gilbert who died in 1873.

He was an elder and prominent member of the Christian Church which he served until his death.

In 1881, Judge Hudson was married to Miss Emma D. Walker, to whom were born three sons and two daughters, all of whom are now living.

He served Jackson County two terms as County Judge, and was an important factor in every needed reform and public enterprise pertaining to the county's welfare.

Judge Hudson was appointed a member of the Board of Agriculture by Governor Folk in July, 1905, and during his term served as vice-president and president, and at the time of his death was vice-president of the Board of Directors of the Missouri State Fair. He took a deep interest in all the affairs of the Board and was a staunch friend of the Agricultural College. It was largely through his untiring efforts, aided by his warm personal friend, Senator Thomas J. Wornall, that an appropriation of $100,000 was secured from the 44th General Assembly for the new Agricultural Building which is now almost completed and ready for occupancy, This building, built of Missouri lime-stone, is an enduring monument to the personal sacrifice and untiring energy of the devotion of these two men to the cause of a better agriculture for Missouri.

Few men have lived who were as universally loved and respected as was Samuel W. Hudson, and whose labors were of greater value to the State. His death occurred at his home, April 26th, 1908, on the farm where he was born.

The following resolutions were officially adopted by the State Board of Agriculture:

"Whereas, The State Board of Agriculture has just been notified of the death of one of its most distinguished and useful members, Judge Samuel W. Hudson, which occurred at his home in Jackson County on the 20th day of April, 1908; therefore,

"Resolved by the Board of Agriculture, now in special session, That we have thus sustained an irreparable loss. During his three years service as a member of this Board, and as vice-president, acting-president, and president, no member or officer could have manifested greater interest or have accomplished greater good for the cause of agriculture in the State of Missouri than he.

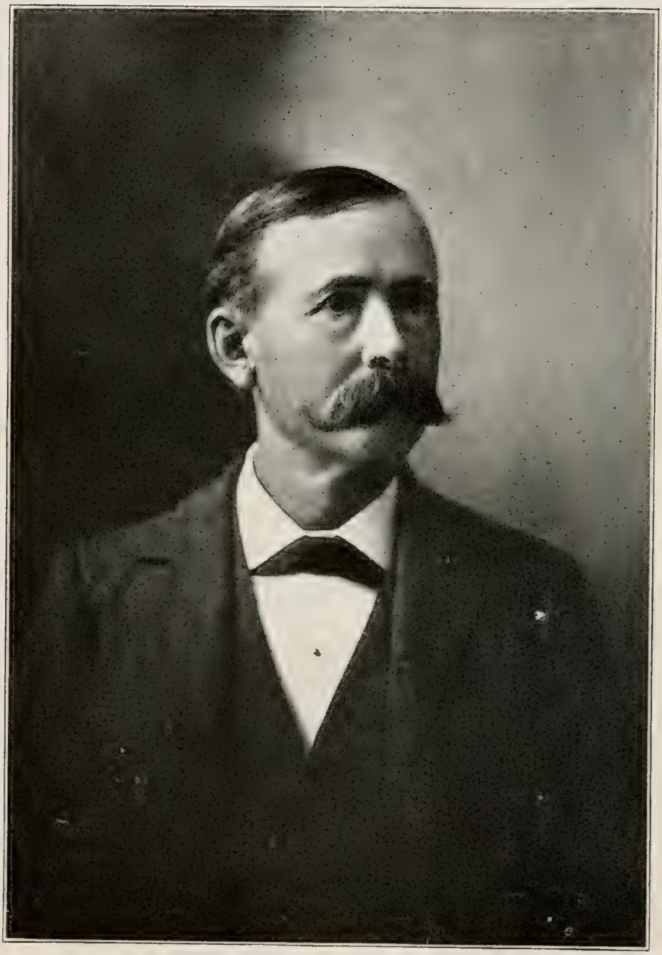
"Resolved, That we express our very deep sorrow on account of the death of our greatly esteemed member and that we express to the bereaved family and to his many warm friends among the farmers of the state, our sincerest and deepest sympathy in their great loss.

"Resolved, That the secretary be instructed to spread a copy of these resolutions upon the records of the Board, and that the same together with a suitable obituary be published in the annual report of the Board.

"Resolved, That the secretary furnish an engrossed copy of these resolutions to the family of the deceased."

GEO. B. ELLIS,

Secretary.



JOHN RICE RIPPEY.
Born 1843. Died 1909.

JOHN RICE RIPPEY.

Born in Schuyler County, Missouri, November 25, 1843.

Educated in the public shools of his county.

Married to Elizabeth Dickerson, of Macon County, October 10, 1867.

Member of the Constitutional Convention in 1875.

Member of the Thirty-first General Assembly of Missouri, 1881.

Member of the State Board of Agriculture from 1883 to 1893.

Member of the Board of Curators of the University of Missouri from 1891 to 1897.

Secretary of the State Board of Agriculture from June, 1893, to January, 1901.

Secretary of the Missouri State Fair, January, 1901, to January, 1908.

A successful farmer and breeder of registered Shorthorn cattle and trotting horses.

Editor of "The Lancaster Excelsior" from 1898 to 1909.

Died at his home in Lancaster, Schuyler County, January 17, 1909.

Such, in brief, is the story of the life of a man who has left a lasting impress upon the State. These honors, numerous and rich as they are, came to him without solicitation and without effort on his part. He was a man who could always be relied upon to plead the cause of a friend, but never his own.

Colonel Rippey believed in Missouri and considered no labor too arduous that would promote here interests

While Secretary of the State Board of Agriculture, he prepared for distribution at the Omaha Exposition, in 1898, a statement of the State's resources, which has become a classic. It was he who coined the phrase, "Missouri, Imperial Mistress of States," a title so appropriate as to be at once adopted.

He was a member of the Board of Curators of the University at the time of the great fire in 1892, and helped to guide the institution through the stormy period of its relocation in Columbia and through the days of the reconstruction of its buildings. On a tablet in the main corridor of the Academic Hall at the University, carved in enduring marble, is an expression of the recognition of his services to this, the foremost educational institution of the commonwealth.

While Secretary of the State Board of Agriculture, he brought this important work of the State into much closer touch with the people and developed it along lines of greater usefulness. The Annual Reports and bulletins he edited were filled with practical information and were widely sought.

When called to the position of Secretary of the State Fair, that institution had just been established and was without buildings, or other equipment. In the seven years of his administration as Secretary, this institution became one of the foremost of its kind in the country.

One of the most characteristic traits of Colonel Rippey even unto his death was his interest in and fondness for young people. He was a man who faced the future and had faith in what it would bring.

H. J. WATERS,
Dean of the College of Agriculture.

ANNUAL MEETING.

MINUTES OF PROCEEDINGS.

State Board of Agriculture, Office of the Secretary,
Columbia, Mo., December 15, 1908.

In compliance with the provisions of the law, the members of the State Board of Agriculture convened in the office of the Secretary in forty-fifth annual session.

The meeting was called to order by the President, Hon. Norman J. Colman, and a roll-call showed the following members present: Messrs. Colman, Howell, Hutchison, Deerwester, Boles, Greensfelder, Nelson, Christian, Wilkinson, Sampson, McRoberts, Gentry, Smith, Waters, Gass, Young, Thompson, and Swink.

The reading of the minutes of the last annual meeting was the next order of business, and upon motion of Mr. Gentry that was dispensed with, and the minutes as printed in the 40th annual report were adopted.

The Secretary's report was submitted, and upon motion of Mr. Christian the report was received and ordered printed.

Mr. Greensfelder moved that the Chair appoint a committee of three, to whom should be referred the recommendations of the Secretary. Motion carried. The Chair appointed Messrs. Nelson, Young and Smith on the committee.

The State Veterinarian, Dr. Luckey, read his report, and, on motion of Mr. Boles, the report was received and ordered printed. Mr. Greensfelder moved to refer the recommendations of the Veterinarian to the committee on Secretary's report. Motion carried.

Mr. Hill, State Highway Engineer, submitted the annual report of his office, and, on motion of Mr. McRoberts, the report was received and ordered printed.

The State Apiary Inspector, M. E. Darby, submitted his report, and, on motion of Mr. Greensfelder, the report was received and ordered printed.

AUDITING COMMITTEE.

The committee appointed to examine the books and accounts of the Secretary and Treasurer submitted the following report:

To the Board of Agriculture:

We, the undersigned committee, authorized by the President to examine the books and accounts of the Secretary and Treasurer, have examined the financial statements of the Secretary and Treasurer, and find that the vouchers on file and the cancelled warrants with corresponding numbers in the hands of the Treasurer, agree.

The following warrants, which had been issued at the last annual settlement, but had not been presented for payment, we find have since been paid:

FARMERS' INSTITUTE FUND.

No. 909—Amount	$38 06

STATE VETERINARY FUND.

Nos. 2011-2017—Amount	$145 37

KANSAS CITY INTERSTATE FAIR FUND.

No. 94—Amount	$33 50

STATE HIGHWAY ENGINEER FUND.

No. 23—Amount	$32 40

The following warrants, for which corresponding vouchers were on file, have not yet been presented for payment:

FARMERS' INSTITUTE FUND.

No. 1020—Amount	$3 15
1022—Amount	2 00
1023—Amount	96 54
1025—Amount	20 66
1028—Amount	30 00
Total	$152 35

Respectfully submitted,

(Signed) J. W. Boles,
John Deerwester,
M. B. Greensfelder,
Committee.

Mr. Nelson moved that the report be accepted and the committee discharged. Motion carried.

ELECTION OF OFFICERS.

The next order taken up was the election of officers for the ensuing year.

Mr. Howell moved that the rules be suspended, and that H. J. Waters be elected president by acclamation. The motion unanimously prevailed, and the Chair declared Mr. Waters elected.

Mr. Smith moved to suspend the rules and elect Mr. Deerwester to the office of vice-president. The motion was carried unanimously. The President declared Mr. Deerwester elected.

Mr. Gentry moved that the rules be suspended, and that Mr. Ellis be elected secretary by acclamation. Motion prevailed, and Mr. Ellis was declared elected.

Mr. Waters moved to suspend the rules, and that W. L. Nelson be elected assistant secretary. Motion carried.

Mr. Gentry moved that the rules be suspended, and that Miss J. B. Rector be elected to the position of head stenographer, and that the annual salary be fixed at $780, to be paid monthly. Motion prevailed.

Mr. Christian moved to suspend the rules, and elect W. A. Bright treasurer. Motion prevailed.

Mr. Howell moved that an executive committee of three be elected, and that the President and Vice-President-elect shall be two members of said committee. The vote on the motion stood 9 ayes and 7 noes. On motion of Mr. Boles, the vote was made unanimous. Mr. Christian moved to elect Mr. McRoberts to a place on the executive committee. Motion prevailed.

The Committee on College of Agriculture submitted the following report:

REPORT OF THE COMMITTEE ON AGRICULTURAL COLLEGE.

Your committee appointed to examine into the affairs of the College of Agriculture and Experiment Station have discharged that duty, and beg leave to submit the following report:

The buildings, grounds, orchards and herds show a marked improvement in condition, and are, so far as they extend, well worthy of the institution, the State and the industry which they represent.

The New Agricultural Building.—On a beautiful site on a corner of the horticultural grounds, midway between the main

University campus and the Agricultural College buildings on the farm, is now in process of erection the handsomest building in the University group, the new home of the College of Agriculture and of the State Board of Agriculture. This building is 266 feet long, three stories high, constructed of native limestone quarried on the College grounds, and thoroughly fire-proof. It is well adapted to the uses to which it will be put. It contains an auditorium with a seating capacity for 500 persons, to be used for farmers' conventions and for the accommodation of large classes of students in the College of Agriculture. It is a matter of congratulation that so large, well planned, well constructed and so handsome a structure is to be secured for the appropriation made by the last General Assembly. This building will be completed within a few months, and will need to be equipped with laboratory desks, hoods, scientific appliances and furniture, and we would recommend that the legislature appropriate for this purpose the sum of $15,000.

More Liberal Support for the College of Agriculture and Experiment Station.—Missouri has not been as liberal with its College of Agriculture as it should have been. The last Illinois legislature appropriated nearly four times as much money to its college of agriculture as Missouri has given hers in its entire existence of thirty-eight years. Kansas last year appropriated to its college of agriculture more than twice as much money as Missouri has given hers since it was founded. Even the new state of Oklahoma has already expended on her college of agriculture much more money than has Missouri expended on hers.

It should be realized that money appropriated to the College of Agriculture and Experiment Station and the Board of Agriculture is not money spent in the ordinary sense, but is money most wisely invested. For example, in an experiment conducted in South Missouri by the College, by proper fertilization the yield of corn was increased from 18 to 45 bushels per acre on thin land. This is 50 per cent more than the average yield per acre of this county, and showed a net profit over and above the cost of fertilizer and treatment of $4.67 per acre, which, when applied to the 95,000 acres planted to corn, it would amount in a single year to $441,750, or more than twice as much as the State has given to the College of Agriculture since it was organized in 1870. Reducing this increase one-half, and applying it to the 7,000,000 acres normally grown in corn in the State, we would have a net increase in the farmers' returns of $15,850,000—enough to construct ten macadam roads across the State, or to macadamize all the roads in four of the largest counties of the State each year. This would be sufficient to erect an $100,000 agricultural high school in every county in Missouri, and the extra yearly increase would provide similar sums for their support.

We consider the work of the Veterinary Department of the College of Agriculture and Experiment Station as of prime importance to the live stock industry of the State, and this Board has previously called attention to the important services this Department has rendered to the country, and has urged that proper facilities be provided, in order that greater efficiency may be attained. But notwithstanding the valuable work done by this Department in the past and the valuable work on hog cholera now in progress, we find that this Department still suffers from the handicap of very meager facilities. We regard it as unjust to this Department and to the live stock industry that such conditions should continue.

The value of the live stock of Missouri exceeds two hundred millions of dollars, the value of swine alone being not less than 45 millions. Investigation of the diseases of animals and the means of prevention should therefore receive every encouragement. It is unwise economy to hamper this work with poor quarters and meager funds.

We deem it essential that the students of Agriculture who go out into practical and scientific work should be well drilled in the elements of Veterinary Science, which are so closely related to the work of stock breeding, stock feeding, and stock judging, such as veterinary anatomy, veterinary physiology and veterinary hygiene, and such instruction in the simpler things of medicine and surgery as will enable the students to handle in a rational manner such cases as do not demand professional veterinary aid.

We find that the work of this Department is now carried on partly in the live stock building and partly in the dairy building, much to the inconvenience of these departments. The dissecting is done in small rooms in the live stock building, within a few feet of the live stock judging room. These rooms are now overcrowded with large numbers of students; and with the increase in the attendance at the Agricultural College, which will come from year to year, the difficulties will grow.

We also find this Department has no shelter for its demonstration and investigation work on diseases of stock, and as a greater part of this instruction work occurs during the winter season the importance of adequate shelter is apparent.

We, therefore, recommend that an appropriation of twenty thousand dollars ($20,000) be made by the General Assembly to provide for a proper building for the accommodation of the work mentioned. We further recommend that a special appropriation of ten thousand dollars ($10,000) be made for the erection and equipment of suitable experiment barn and sheds for the investigation of contagious diseases and particularly for carrying on the work in hog cholera. And an appropriation of five thousand dollars ($5,000) annually for the purchase of experimental animals—hogs, horses and cattle—for use in the hog cholera investigations, and to cover the expense of producing and dissemination of hog cholera serum.

The Soil Survey.—We are pleased to learn that the soil survey work has progressed so far as to include a careful preliminary study of the whole Ozark region. The northeastern prairie region of the State is partly surveyed, as is also the western prairie section. A detailed survey of four counties has been completed. The report on the Ozark region is in the hands of the printer, and will be published in the very near future. Too much emphasis cannot be laid upon the importance of this work. At the very foundation of a rational system of crop growth and soil management must be an accurate and detailed knowledge of the soil itself. This survey takes account of stock, and tells each farm owner what is the future as well as the present value of his farm. The survey should be pushed as rapidly as trained men can be found to carry it out, and continued until each county has been carefully surveyed and reported upon.

The Board of Curators should not ask for less than $20,000 for the support of this work during the next two years.

Outlying Experiments.—The work of the Department of Agronomy in testing the fertilizer requirements of soils in different parts of the State, in studying the effect of different crop rotations, different varieties of corn, wheat, oats and forage crops upon different sections and soils, in studying the feasibility and profitableness of tile draining on some of the flatter prairie soils of the State, cannot be too highly commended. This work should be continued, and should be materially enlarged. We find experiments already under way in more than 90 of the 114 counties of the State. It should be immediately extended so as to include every county in the State, and the scope of many of the experiments now under way should be enlarged. The counties should, wherever possible, bear a portion of the cost of these experiments, authority for which was granted under the Nelson Act of the 44th General Assembly.

Not less than $20,000 should be provided by the legislature for this phase of the college work for the next two years.

Origination and Dissemination of Improved Varieties of Farm Crops.—Several million dollars may be added immediately to the wealth of the State by the more general use of improved varieties of corn, wheat, oats, etc. The College of Agriculture and Experiment Station should originate, propagate and disseminate new sorts better adapted to Missouri's soil and climate than any we now have. For this purpose more tillable land will be required than is provided on the College Farm, and we would recommend that the University authorities ask the legislature to provide an additional farm for the College at the earliest possible moment that the revenue will permit.

We find over 100 students crowded into one small building studying the propagation of plants, and when the short course in Agriculture opens, in January, another hundred will have to be provided with room. The present facilities for this work need to be more than doubled immediately, and we would recommend that the sum of $3,000 be provided for this purpose.

The horticultural grounds, where the orchard experiments are conducted, should be tile drained, in order to be at all well adapted to the growth of experimental fruits.

We would recommend that the Horticultural Department be provided with $5,000 with which to conduct experiments in the fertilizing of bearing orchards, the methods of suppressing fungus diseases, and of packing and marketing fruit in different parts of the State.

A similar sum should be provided for experiments and demonstrations in the methods of combating insect pests by the Department of Entomology, particularly for the checking of the ravages of the San Jose scale.

Animal Husbandry Work.—The herds of live stock on the farm are to be especially commended for their quality and condition. The numbers should be somewhat increased and this high standard maintained, and we would recommend that the sum of $5,000 be provided for this increase in numbers.

We would strongly recommend that the exhibit of fat steers at the leading State and international shows of the country be continued; that the student stock judging contest be participated in, and that the stock judging contest at the State Fair be emphasized, and, if possible, enlarged. It is gratifying to learn that more than two-thirds of the best county fairs and livestock shows in Missouri availed themselves this year of advanced students and graduates of the Agricultural College as expert judges in their exhibits.

It is equally gratifying to be able to report that during the past two years the College has won 225 prizes on its fat cattle, fed mainly by students, at the principal State and international stock shows of the country in competition with the leading herds of America. The University should provide ample funds for maintaining this work on its present high plane.

We note the crowded condition of the present live stock judging pavilion, and appreciate that it is wholly out of the question to undertake to carry this important work on with even the present enrollment without additional facilities, and we would recommend that the sum of $10,000 be provided for the erection of an additional building for this purpose.

A suitable horse barn costing not less than $7,000 should also be provided.

The Dairy Department.—Your committee points with special pride to the achievements of the College herd of dairy cows during the past year. It has already taken rank as one of the best dairy herds in the world. Of most significance, the animals have all been bred by the College. Eight Jersey cows have made an average butter record of more than 700 pounds each per year. The College has put more Jerseys in the registry of merit list than all the rest of the State combined, and these cows have shown the highest average of any in the record of merit list in the United States. One of its cows has established a new world's butter record as a three-year-old, making 715 pounds in twelve months. Another cow stands second in the world's butter production for a cow of any age, and is also second in milk production.

The College herd has likewise put into the advanced Holstein registry a larger number of animals than have all of the other Holstein breeders in Missouri combined.

It is to be regretted that this valuable herd is stabled in an old, unsanitary barn, and we would strongly recommend that the legislature provide not less than $12,000 for the erection of a suitable dairy barn, which should be a model in arrangement and construction for all of the dairymen of the State.

The dairy industry in Missouri is developing at a rapid rate, and we would recommend that additional instructors be provided in this subject to meet the increased demand at the College.

We would also recommend that a sufficient sum be provided for the publication and dissemination of literature on this subject, in order that this new industry may be upon a permanent basis and may develop along rational lines.

Secondary Instruction in Agriculture.—The increase in the number of students in attendance upon the College of Agriculture is exceedingly gratifying. The character of the instruction is beyond question. Now, that it has its collegiate instruction on a good basis, it is the opinion of your committee that the College should give serious attention to secondary instruction in Agriculture and to its introduction into the rural schools. We would, therefore, suggest that steps be immediately taken to organize instruction in Agriculture and Home Economics of a secondary grade in the University, in order that the boys and girls may come directly from the district school to the University and acquire the necessary information to become better farmers or farmers' wives, without being required to pursue a course in a high school preparatory to admission. The Board of Curators should, therefore, ask the present legislature for the necessary funds for employing teachers and for providing whatever facilities may be necessary in the way of buildings or equipment to begin this work at the opening of the next session of the University.

The Department of Home Economics.—This Department is crowded into quarters wholly inadequate and unsuited, and we would strongly recommend that the sum of $35,000 be provided for the erection of a special building for this purpose, and for the proper equipment of this Department.

We would recommend that the sum of $2,000 be appropriated for the expense of making a first-class educational exhibit and demonstration of the work of the College and Experiment Station at the State Fair, and at the leading county fairs of the State.

We would recommend that the student judging teams sent out by the College in other lines than live stock, such as grain judging, judging dairy cattle, etc., be continued, and that the University encourage this in every legitimate way.

All of which is respectfully submitted,

(Signed) A. T. NELSON,
R. A. YOUNG,
SANFORD MC SMITH,
Committee.

Mr. Greensfelder moved that the report be received and adopted as the sentiment of the Board, and further that the committee already appointed to act on the Secretary's report be authorized to present in person the report to the Governor. Motion carried.

Mr. McRoberts moved that Mr. Greensfelder be added to the committee. Motion carried.

Mr. Thompson moved that the committee already appointed be constituted a legislative committee to recommend legislation along the lines approved by this meeting. Motion prevailed.

Mr. Nelson moved that the President and Secretary be added to the membership of the legislative committee. Motion carried.

Mr. Gass moved that the legislative committee have full power of the Board in all matters of legislation, and that they may confer with any member of the Board when deemed advisable. Motion prevailed.

Mr. Gass moved that the President appoint a committee to which should be referred the suggestions of the Secretary on secondary agriculture in schools. Motion prevailed.

Mr. M. E. Darby, State Apiary Inspector, offered his resignation so that the term might end with the calendar year. The resignation was accepted, and, upon motion of Mr. Gentry, Mr. Darby was elected Apiary Inspector for two years, the term beginning January 1, 1909.

Mr. Nelson moved that a committee of two be appointed to try to harmonize the differences between the Board of Horticulture and the State Horticultural Society. The motion prevailed, and the Chair appointed Mr. Nelson and Judge Wilkinson on the committee.

Mr. Greensfelder announced to the Board that he desired to have established on his farm in St. Louis county, a county experiment station under the provisions of the Nelson Act of 1907, and asked for the appointment of two members of the faculty to confer with the county court and himself in regard to the agreement.

On motion of Mr. Greensfelder, the President-elect was authorized to appoint the committee.

Judge Wilkinson moved that all power vested in the Board of Agriculture be and is hereby delegated to the executive committee, and that the said committee is hereby authorized to act for the Board at all times when the full board is not in session. Motion seconded by Mr. Thompson, and unanimously prevailed.

There being no further business, the Board adjourned.

GEO. B. ELLIS, Secretary.

REPORT OF SECRETARY.

Gentlemen of the Board of Agriculture:

In the cycle of time the day is here for reviewing the work of the year, that we may know what has been accomplished and make plans for future improvement. The crops for the year 1908 have not yielded so bountifully as for some other years, but after all damage from a bad season, overflow, and the ravages of insects, we find that the Missouri farmer has produced sufficient for home use, and some to spare. The aggregate product of all farm crops is considerably less than for the previous year, but on account of better prices the aggregate value is about the same. Our reports show a marked tendency towards greater diversification of crops, more definite systems of rotation, and the introduction of crops that will produce a greater food value per acre. These things have been taught through the publications of the Board and of the Agricultural College and Experiment Station, and farmers' institutes, and that our teaching has been sound is evidenced by the fact that thousands of farmers are taking up the methods demonstrated by the Experiment Station to be good.

During the year, this office has arranged for and conducted 260 farmers' institutes, at which 35,000 farmers were in attendance. In addition to the regular institutes, the State Highway Engineer has held a number of road meetings which were usually attended by a large number of farmers and road officers. Also, almost every week, articles on timely subjects have been prepared by some one connected with the office and sent out to the agricultural and county weeklies of the State. The 40th Annual Report, a book of 507 pages, and twelve numbers of the Monthly Bulletin, have been published during the year. These publications have contained information on practically every subject relating to crop growing, on dairying and on breeding and feeding farm live stock. The wide range covered by the twelve bulletins is indicated by the following titles:

No. 1—Farm Practice in Northeast Missouri.
No. 2—The Silo.
No. 3—Highway Engineers' Association.
No. 4—Boys' Corn-Growing Contest.
No. 5—Earth Roads.
No. 6—Raising Calves on Skim Milk.
No. 7—Highway Bulletin on Contracts.
No. 7a—Experiments on Missouri Soils.
No. 8—Bridges and Culverts.
No. 9—Roads—Bad and Good.
No. 10—Parasitic Diseases of Sheep.
No. 11—Diseases of Bees.
No. 12—The Poultry Industry in Missouri.

BOYS' ENCAMPMENTS.

The first farm boys' encampment, or, more correctly speaking, a summer school for farm boys, was held in Gentry county, in August, 1907, under the management of S. M. Jordan, the institute specialist of the Board of Agriculture. The work was so successful that it was thought wise to organize a number of encampments this year, and I am able to report that the work has been most gratifying to this office. Encampments were held this year at Maryville, Rockport, Kirksville, Butler and Sweet Springs. At Maryville and Rockport, the attendance and interest were both interfered with, because the meetings were held in connection with their annual chautauquas. The largest meetings were at Butler, with 255 boys present, and at Sweet Springs with 286 boys. The work consisted of lectures on crop-growing, plant breeding, soil improvement, animal husbandry, horticulture and dairying, and exercises in corn judging, soil work and live stock judging. I consider this work important for two reasons: First, for the direct instruction of the boys; second, by interesting the boys in the work of the Agricultural College. The methods of agriculture could be greatly improved if not revolutionized in a few years if a meeting of this kind could be held annually in each county.

FARMERS' INSTITUTES.

The farmers' institute work is settling down to a better system, and the farmers are demanding instruction rather than entertainment. The greatest difficulty that I find, however, is to secure competent institute lecturers. The college faculty have not the time without neglecting their class work, and it is hard to find others who are willing to engage for only a few weeks in the year. The Board has now two men—namely, S. M. Jordan and F. G. King—employed for their whole time, and their work has proven very satisfactory.

The plan, mentioned in my last report, of giving short courses in agriculture, has been extended this year with good results. Meetings of this kind have been held, or arranged for, at Doniphan, Whitesville, Stanberry, Kirksville, Cape Girardeau, Springfield, Carthage and Sarcoxie. The work given varies according to local conditions, but the general plan is the same. The following is the outline for the Cape Girardeau meeting, which will give an idea of the character of the work:

FIRST DAY—MORNING.

Lecture—The Relation of Animal Husbandry to Systems of Farm Management—Prof. F. B. Mumford.

Lecture—The Location of Fruit Plantations and Preparation of the Ground (Soil, slope, elevation, drainage, etc.)—Dr. J. C. Whitten.

AFTERNOON.

Demonstration in Live Stock Judging—Prof. Mumford.

Demonstration—Age and character of trees, vines and plants to be set; pruning plants for setting—Dr. Whitten.

SECOND DAY—MORNING.

Lecture—Principles of Animal Feeding—Prof. Mumford.

Lecture—Varieties of Orchard Fruits and Berries to be Grown—Dr. Whitten.

AFTERNOON.

Practical Demonstrations in Live Stock Judging—Prof. Mumford.

Demonstration—Diseases illustrated with specimens and methods of control of same by spraying, etc.—Dr. Whitten.

THIRD DAY—MORNING.

Lecture—The Improvement of Domestic Animals; The Animal Machine—Prof. Mumford.

Lecture—Why We Prune Trees and Plants—Dr. Whitten.

AFTERNOON.

Pruning Demonstrations—Dr. Whitten.

FOURTH DAY—MORNING.

Lecture—Corn Breeding—S. M. Jordan.
Lecture—Hog Cholera—
a. Losses from it in past six years.
b. Immunization of hogs against cholera.
c. Plans to stop all losses and entirely eradicate the disease from the State—Dr. D. F. Luckey.

AFTERNOON.

Demonstration—Corn Judging—Mr. Jordan.
Immunization of Hogs—Dr. Luckey.

FIFTH DAY—MORNING.

Lecture—Seed Selection—Mr. Jordan.
Lecture—Tuberculosis of Cattle and Hogs—
a. Its increase.
b. Losses from it.
c. Plans for its control and eradication from Missouri—Dr. Luckey.

AFTERNOON.

Seed Testing—Mr. Jordan.
Testing Cattle for Tuberculosis—Dr. Luckey.

SIXTH DAY—MORNING.

Lecture—Corn Cultivation—Mr. Jordan.
Lecture—Development of the Independent Packing Industry in Missouri.
a. The great opportunity of the present time.
b. Is a packing house ham better or cheaper than a country ham?
c. Why country people pay freight on cattle and hogs to market, and on meat back again after three or four commissions have been added to the price of it.

d. If meat should be clean on the dining-room table, in the kitchen and the butcher-shop, why not in the grocery-store and the country slaughter-house?

e. The public municipal abattoir—Dr. Luckey.

AFTERNOON.

Post-mortem on Tuberculous Cow—Dr. Luckey.
Demonstration—Mr. Jordan.

SEVENTH DAY—MORNING.

Lecture—The Earth Road—Curtis Hill, State Engineer.

AFTERNOON.

Drag Demonstration for maintenance, provided the weather permits.

EIGHTH DAY—MORNING.

Lecture—The Hard-Surfaced Road—Mr. Hill.

AFTERNOON.

Drag Demonstration for Maintenance—Mr. Hill.

NINTH DAY—MORNING.

Lecture—Culverts and Bridges for Highways.

AFTERNOON.

Road Conditions in Missouri—Mr. Hill.

PUBLICITY.

For a long time I have felt the need of giving greater publicity to the work of the office, and particularly to advertising to the outside world the great diversity and magnitude of Missouri's agricultural, live stock, horticultural, and dairy products, but for lack of funds and the necessary help the work could not be done. The Executive Committee, at a meeting held on May 27th, appointed, upon my recommendation, Mr. W. L. Nelson, of Cooper county, Chief Clerk in the office. Mr. Nelson assumed charge of his duties on the 10th of August, and his time has been occupied in collecting data on the resources of the State and in preparing material for the public press. In addition to this, Mr. Nelson has just completed the material for a large and very valuable bulletin on poultry raising. Mr. Nelson's experience in agricultural and general newspaper work, his knowledge of good farm practice, and his business experience, fit him admirably for the work.

STATE STATISTICAL LAW.

There is great need in this State for a law requiring the assessors to take a census of all live stock and agricultural products, that our reports may become positively accurate. The trade of the country in many lines depends largely on the United States, and the different State reports, as a basis for business operations. Under the present system in this State, which is practically the same as the system practiced by the United States Department of Agriculture, there is too much chance for error. I give herewith a draft for a law that can be put into effect in this State with scarcely any cost, and which will insure accuracy in all of our statistical work:

"Section 1. It shall be the duty of the assessors of the several counties, and the township assessor in counties now having or which may hereafter adopt township organization in this state in addition to the duties now required by law, annually at the time of making assessments of real and personal property, to require and take with each assessment list upon separate blanks to be provided as other blanks are now provided for, a statement from each individual, firm or corporation:

1. The number of acres cultivated in the leading farm crops of the state,
2. The amount each crop produced.
3. Such statement of live stock, dairy products, poultry products, horticultural, and other products, with farm prices of same, as shall be designated by the State Board of Agriculture. Such statement shall be for the preceding year.

"Section 2. Said statement shall be returned by the assessor to the county clerk, at the same time of returning the assessed lists of property, and the county clerk shall immediately forward the same to the Secretary of the Board of Agriculture, at his office, who shall publish an aggregate statement of same in his annual report, or otherwise, as he may direct.

"Section 3. It shall be the duty of the State Auditor to make out and forward to each county clerk, in the same manner as forms are furnished for the assessment of property, suitable forms and instructions for carrying this article into effect,

Provided, that the State Auditor shall include in such forms such questions as may be furnished by the State Board of Agriculture.

"Section 4. It shall be the duty of the county clerk to furnish a sufficient number of blank forms to the assessor for taking the statistics required in Section 1, of this article.

"Section 5. By reason of the fact that the statements required by this Act are desired for the year 1909, creates an emergency within the meaning of the constitution; therefore, this Act shall be in force and take effect from and after its passage."

HIGHWAY ENGINEER, VETERINARY SERVICE, APIARY INSPECTION.

For information on these lines of work, I commend for your consideration the reports of Mr. Hill, the Engineer; Dr. Luckey. State Veterinarian, and Mr. Darby, Apiary Inspector.

LOOKING TO THE FUTURE.

The law incorporating the State Board of Agriculture, provides that "The State Board of Agriculture shall be and is hereby constituted the body which shall have supervision of all the legalized departments and institutions of the State which are for the advancement of agriculture." This is very broad in its meaning, perhaps more so than has been carried out in practice. I would like to mention here only a few of the things that have recently been accomplished and which were first recommended by this Board. In 1899, the Board recommended an appropriation of $40,000 for a dairy and live stock building. The money was appropriated and the building erected in 1901. In 1900, an appropriation for a new horticultural building was recommended, and the legislature gave the money the next year. In 1902, the Board recommended an appropriation for a new barn, machine laboratory, and extra live stock, all of which were secured.

The soil survey work was established upon the recommendation of this Board. In 1906, this Board urged the Board of Curators to train and support judging teams to represent the Agricultural College at the American Royal, International and other expositions, and this has been done with gratifying results. Also, as a result of a conference of a commission of this Board, with the Board of Curators, a number of the farm live stock have been exhibited at the leading expositions during 1907-8, and the live stock shown has won during these two years, 180 premiums, to the great gratification of Missouri's Live Stock Breeders.

In 1906, the Board recommended an appropriation for an experimental poultry plant in the Experiment Station, and the legislature made the appropriation. At the same meeting, this Board urged the necessity for a new Agricultural Building, and as a result, a handsome building is now in course of erection, and ought to be completed before the next annual meeting.

Perhaps the greatest achievement accomplished by the initiative of the Board, was the enactment of the new road law, and providing for State aid to the amount of $1,475,000; however. only $475,000 of this fund has up to the present time been made available.

I might mention other things, but these will suffice to show what the Board may accomplish by working for the betterment of facilities for the improvement of agriculture in Missouri.

Looking to the future, I would like to recommend:

First—that this Board appoint a standing committee whose duty it shall be to work for legislation bringing about the establishment of secondary schools and courses of study for the teaching of Agriculture, Home Economics and other industrial studies. Missouri has a harvest of 15,000 farm boys and 15,000 country girls ripening into manhood and womanhood every year, and scarcely any provision is made for training them along the lines of their future life work.

Second—that an appropriation be asked for from the 45 General Assembly, providing for an immigration agency under the direction of the Board, to the end that desirable immigrants may be brought into the State, and assist in developing our great natural resources.

Third—that following the recommendation of the late Dairy and Food Commissioner, that the legislature separate the work of dairy development and instruction from the police and food inspection work, and that the instruction be put in charge of the Board of Agriculture.

Fourth—The precedent of giving State aid for road improvement having been established by the 44th General Assembly the Board should urge an appropriation of not less than $500,000, to be used only for permanent road work and conditioned upon the counties spending a like amount.

Respectfully submitted,

GEO. B. ELLIS, Secretary.

ABOUT THANKSGIVING TIME.

SECRETARY'S FINANCIAL STATEMENT.

To the Board of Agriculture:

I beg leave to submit the following exhibit of the financial transactions of the Board for the year beginning December 17th, 1907, and ending December 15th, 1908, which shows the balances on hand at the beginning of the year, the requisitions drawn on State Auditor, warrants drawn on W. A. Bright, Treasurer of the Board, balances in the treasury of the Board, and the balances in the different funds remaining in the State treasury:

EXPENSE OF MEMBERS FUND.

Date.	War. No.	Name.	Dr.	Cr.
1907.				
Dec. 17		To balance	$314 58	
" 18	704	By A. R. Young		$32 80
" 18	705	S. W. Hudson		21 20
" 18	706	J. W. Boles		7 55
" 18	707	John Deerwester		12 50
" 18	708	W. R. Wilkinson		10 00
" 18	709	N. H. Gentry		6 20
" 18	710	A. M. Thompson		16 15
" 18	711	Sanford McSmith		13 75
" 18	712	W. B. McRoberts		10 00
" 18	713	N. J. Colman		11 00
" 18	714	J. L. Christian		25 00
" 18	715	W. C. Hutchison		16 00
" 18	716	E. E. Swink		15 50
" 18	717	H. A. Gass		7 15
" 18	718	M. B. Greensfelder		15 34
" 18	719	A. T. Nelson		22 70
1908.				
Feb. 1	720	H. J. Waters		14 34
" 1	721	S. W. Hudson		3 60
" 1	722	W. R. Wilkinson		22 00
" 1	723	J. L. Christian		11 00
" 1	724	W. C. Hutchison		12 25
" 1	725	Geo. B. Ellis		12 99
" 1	726	W. B. McRoberts		17 00
Mar. 2		To requisition	200 00	
" 27	727	By A. T. Nelson		23 70
" 27	728	W. C. Hutchison		13 80
" 27	729	S. W. Hudson		27 00
May 27	730	W. B. McRoberts		12 50
" 27	731	W. C. Hutchison		12 50
July 1	732	Shields & Courts		3 00
Aug. 1		To requisition	100 00	
" 6	733	By W. C. Huthchison		18 40
" 6	734	Geo. B. Ellis		6 39
Sept. 4	735	W. C. Howell		13 25
" 4	736	H. J. Waters		9 04
" 4	737	Geo. B. Ellis		8 04
Oct. 2	738	W. B. McRoberts		15 00
" 31	739	Shields & Courts		6 00
" 31	740	Geo. B. Ellis		5 64
" 31	741	N. J. Colman		10 00
Dec. 1		To requisition	200 00	
" 15		By balance		294 30
			$814 58	$814 58

DISTRIBUTION OF ANNUAL REPORT FUND.

Date.	War. No.	Name.	Dr.	Cr.
1907.				
Dec. 17		To balance	$103 76	
1908.				
Jan. 7	142	By American Express Co		$11 42
Feb. 1	143	Scurlock's Transfer		13 34
" 1	144	Eloise Kneisley		1 80
Mar. 2	145	S. H. Elkins		24 00
May 1	146	Pacific Express Co		16 01
" 27	147	S. H. Elkins		24 00
" 27	148	S. H. Elkins		120 00
" 27		To requisition	300 00	
Aug. 6	149	By M. H. Lamb		100 00
" 31	150	S. H. Elkins		60 00
" 31	151	American Express Co		29 19
" 31	152	Pacific Express Co		3 49
Oct. 2		To requisition	78 43	
" 2	153	By Pacific Express Co		78 94
			$482 19	$482 19

OFFICE EXPENSE FUND.

Date.	War. No.	Name.	Dr.	Cr.
1907.				
Dec. 17		To balance	$137 34	
1908.				
Dec. 18	685	By Columbia Telephone Co		$13 90
Jan. 7	686	Count Harvey		19 51
" 7	687	Smith Premier Co		13 00
" 7	688	J. R. Ellis		10 00
Feb. 1	689	J. R. Ellis		10 00
Mar. 2	690	J. R. Ellis		10 00
" 27	691	W. E. Harshe		2 30
" 27	692	National Paper Co		2 75
" 27	693	A. M. Schweich		1 50
" 27	694	Barnes-Crosby Co		6 90
" 27	695	J. R. Ellis		10 00
May 1	696	Columbia Statesman		17 00
" 1	697	Columbia Telephone Co		2 60
" 1	698	W. E. Harshe		2 60
" 1	699	Barnes-Crosby Co		8 98
" 1	700	J. R. Ellis		10 00
" 1	701	Western Union		2 65
" 1	702	Count Harvey		8 80
" 1		To requisition	100 00	
" 27	703	By J. R. Ellis		12 00
" 27	704	Alex Stewart		3 00
" 27	705	Herring-Hall-Marvin Safe Co		23 00
" 27	706	American Express Co		8 95
" 27	707	Columbia Telephone Co		12 40
" 27	708	Count Harvey		11 00
" 27	709	D. P. Thomson		1 50
" 27		To requisition	100 00	
June 24	710	By R. P. Scurlock		19 76
July 1	711	H. S. Gladfelter		10 00
" 1	712	H. R. Varnon		12 50
" 1	713	Columbia Telephone Co		6 60
" 1	714	W. E. Harshe		2 50

OFFICE EXPENSE FUND—Continued

Date.	War. No.	Name.	Dr.	Cr.
1908.				
Aug. 1		To requisition	$100 00	
" 6	715	Columbia Statesman		$3 50
" 6	716	Barnes-Crosby Co		18 75
" 6	717	C. C. Newman & Co		1 55
" 6	718	American Express Co		1 65
" 6	719	W. E. Harshe		1 00
Sept. 4	720	W. H. Lionberger		13 15
" 4	721	W. E. Harshe		1 30
" 4	722	Eloise Kneisley		9 45
" 4	723	Columbia Statesman		5 00
" 17	724	H. R. Varnon		16 00
" 17	725	W. H. Lionberger		9 60
Oct. 2	726	Eloise Kneisley		2 65
" 2	727	National Paper Co		2 75
" 2	728	Count Harvey		13 60
" 2	729	S. H. Elkins		45 00
" 2	730	R. P. Scurlock		19 73
" 6		To requisition	100 00	
" 2	731	By Columbia Statesman		42 15
" 31	732	Count Harvey		17 39
" 31	733	C. C. Newman		1 80
" 31	734	Troxell & Finley		31 00
" 31		To requisition	100 00	
Dec. 1	735	By C. E. Baldwin		5 30
" 15		To balance		99 32
			$637 34	$637 34

MONTHLY CROP REPORT FUND.

Date.	War. No.	Name.	Dr.	Cr.
1907.				
Dec. 17		To balance	$104 31	
" 18	444	By Columbia Statesman		$3 00
" 18	445	Smith Premier Co		2 48
" 18	446	S. H. Elkins		20 00
1908.				
Jan. 7	447	Eloise Kneisley		11 02
" 7	448	Smith Premier Co		18 45
" 7	449	Sanders' Engraving Co		3 90
Feb. 1	450	Smith Premier Co		7 00
Mar. 2	451	S. H. Elkins		30 00
" 2	452	Smith Premier Co		5 75
" 2		To requisition	100 00	
" 27	453	By S. H. Elkins		30 00
" 27	454	R. P. Scurlock		1 52
May 1	455	Columbia Statesman		5 00
" 1	456	Smith Premier Co		2 46
" 1	457	National Paper Co		15 77
" 1	458	S. H. Elkins		30 00
" 1		To requisition	100 00	
" 27	459	By S. H. Elkins		2 65
" 27	460	Smith Premier Co		19 15
" 27	461	Columbia Statesman		3 50
" 27	462	S. H. Elkins		32 00
July 1	463	Smith Premier Co		2 55
" 1	464	S. H. Elkins		32 00
" 1	465	Barnes Crosby Co		4 11

MONTHLY CROP REPORT FUND—Continued.

Date.	War. No.	Name.	Dr.	Cr.
1908.				
July 1		To requisition	$100 00	
“ 1	466	By S. H. Elkins		$3 40
“ 28	467	R. P. Scurlock		6 41
Aug. 6	468	Columbia Statesman		28 50
“ 6	469	Smith Premier Co		5 12
“ 6	470	S. H. Elkins		32 00
“ 6	471	National Paper Co		12 90
“ 6	472	S. H. Elkins		1 15
“ 6	473	Columbia Statesman		3 00
“ 31	474	M., K. & T. R. R		32 84
“ 31		To requisition	200 00	
Sept. 4	475	By S. H. Elkins		32 00
“ 4	476	Columbia Statseman		18 50
“ 17	477	R. P. Scurlock		23 43
Oct. 2	478	Smith Premier Co		7 45
“ 2	479	American Express Co		26 75
“ 2	480	S. H. Elkins		20 00
“ 2	481	Columbia Statesman		49 15
“ 31	482	S. H. Elkins		29 00
“ 31	483	Columbia Typewriter Exchange		1 40
“ 31		To requisition	200 00	
Nov. 6	484	By American Express Co		10 73
“ 6	485	S. H. Elkins		8 80
Dec. 1	486	Columbia Statesman		3 00
“ 1	487	S. H. Elkins		20 00
“ 15		By balance		146 47
			$804 31	$804 31

APIARY INSPECTION FUND.

Date.	War. No.	Name.	Dr.	Cr.
1907.				
Dec. 17		To balance	$225 75	
“ 18	5	By M. E. Darby		$180 74
1908.				
Jan. 7	6	M. E. Darby		45 01
May 27		To requisition	500 00	
July 1	7	By M. E. Darby		143 30
“ 1	8	M. E. Darby		165 85
Aug. 6	9	M. E. Darby		167 45
“ 31		To requisition	500 00	
Sept. 4	10	By M. E. Darby		173 45
Oct. 2	11	M. E. Darby		176 65
Nov. 6	12	M. E. Darby		101 71
Dec. 15		By balance		71 59
			$1,225 75	$1,225 75

STATE HIGHWAY ENGINEER FUND.

Date.	War. No.	Name.	Dr.	Cr.
1907.				
Dec. 17		To balance	$437 23	
" 18	25	By Curtis Hill		$103 91
" 18	26	Paul Bayliss		2 50
" 18	27	William Partney		11 85
" 18	28	R. H. Jones		53 50
" 18	29	E. E. Tupes		2 00
" 18	30	T. J. Rodhouse		13 50
" 18	31	W. A. Bright		25 00
" 18	31a	Geo. B. Ellis		8 28
" 18	32	N. J. Colman		6 00
" 18	33	S. W. Hudson		17 00
" 18	34	S. W. Hudson		10 00
1908.				
Jan. 7	35	Columbia Statesman		13 00
" 7	36	Curtis Hill		200 00
" 7		To requisition	1,000 00	
Feb. 1	37	By D. Ward King		52 65
" 1	38	Curtis Hill		261 29
Mar. 2	39	S. H. Elkins		15 00
"	40	Etta Gilbert		33 35
" 2	41	American Express Co		5 20
" 2	42	Smith Premier Co		116 00
" 2	43	Myers Furniture Co		1 10
" 2	44	International Instrument Co		314 92
"	45	Curtis Hill		265 27
" 2		To requisition	1,000 00	
" 27	46	By Etta Gilbert		52 90
" 27	47	Columbia Statesman		13 00
" 27	48	Smith Premier Co		2 45
" 27	49	D. Ward King		137 85
" 27	50	Curtis Hill		355 18
May 1	51	Columbia Typewriter Exchange		54 47
" 1	52	D. Ward King		77 50
" 1	53	International Instrument Co		38 50
" 1	54	Etta Gilbert		50 00
" 1	55	Curtis Hill		277 98
" 1	56	J. C. Pritchard		121 39
" 1	57	S. H. Elkins		10 00
" 1		To requisition	1,000 00	
" 27	58	By Etta Gilbert		50 00
" 27	59	Columbia Statesman		7 00
" 27	60	Herring-Hall-Marvin Co		20 00
" 27	61	Barnes-Crosby Co		23 71
" 27	62	Curtis Hill		261 60
" 27	63	J. C. Pritchard		139 77
" 27	64	S. H. Elkins		20 00
" 27		To requisition	1,000 00	
June 24	65	By R. P. Scurlock		10 04
July 1	66	S. H. Elkins		15 00
" 1	67	Etta Gilbert		50 00
" 1	68	Curtis Hill		234 42
" 1	69	J. C. Pritchard		144 41
" 1	70	American Express Co		7 00
" 1	71	Pacific Express Co		12 06
Aug. 6	72	Columbia Statesman		10 00
" 6	73	National Paper Co		12 90
" 6	74	J. C. Pritchard		157 38
" 6	75	Etta Gilbert		50 00
" 6	76	Curtis Hill		255 97
" 6	77	Columbia Typewriter Exchange		5 05
" 6	78	M. H. Lamb		50 00
" 31		To requisition	1,000 00	

STATE HIGHWAY ENGINEER FUND—Continued.

Date.	War. No.	Name.	Dr.	Cr.
1907.				
Sept. 4......	79	By Barnes-Crosby Co...............	....	$61 12
“ 4......	80	Etta Gilbert....................	....	50 00
“ 4......	81	J. C. Pritchard..................	....	132 72
“ 4......	82	Curtis Hill......................	....	244 26
“ 4......	83	Columbia Telephone Co..........	....	5 30
“ 4......	84	S. H. Elkins.....................	....	15 00
“ 4......	85	S. H. Elkins.....................	....	60 00
Oct. 2......	86	Barnes-Crosby Co................	....	19 05
“ 2......	87	Etta Gilbert....................	....	50 00
“ 2......	88	S. H. Elkins.....................	....	2 50
“ 2......	89	Pacific Express Co...............	....	37 91
“ 2......	90	W. E. Harshe....................	....	7 93
“ 2......	91	Curtis Hill......................	....	229 28
“ 2......	92	R. P. Scurlock...................	....	22 25
“ 2......	93	J. C. Pritchard..................	....	216 27
“ 2......	94	S. H. Elkins.....................	....	30 00
“ 2......	....	To requisition......................	$1,000 00	
“ 2......	95	By Columbia Statesman............	....	22 50
“ 10......	96	Columbia Statesman.............	....	12 77
“ 27......	97	S. H. Elkins.....................	....	30 00
“ 31......	98	Etta Gilbert....................	....	50 00
“ 31......	99	Smith Premier Co................	....	12 67
“ 31......	100	National Paper Co...............	....	10 16
“ 31......	101	J. C. Pritchard..................	....	144 72
“ 31......	102	R. P. Scurlock...................	....	3 54
“ 31......	103	S. H. Elkins.....................	....	45 00
“ 31......	104	Curtis Hill......................	....	306 63
Nov. 6......	105	Columbia Statesman.............	....	12 50
“ 6......	106	Columbia Telephone Co..........	....	13 20
Dec. 1......	107	J. C. Pritchard..................	....	127 12
“ 1......	108	Columbia Statesman.............	....	45 00
“ 1......	109	Etta Gilbert....................	....	50 00
“ 1......	110	S. G. Adams Stamp Co...........	....	14 50
“ 1......	111	W. A. Bright....................	....	35 00
“ 1......	112	Curtis Hill......................	....	310 13
“ 1......	113	R. H. Jones.....................	....	45 26
“ 1......	114	Columbia Statesman.............	....	24 50
“ 1......	115	S. H. Elkins.....................	....	20 00
“ 1......	....	To requisition......................	1,000 00	
“ 1......	116	By Count Harvey.................	....	14 08
“ 15......	....	To balance.........................	....	645 51
			$7,437 23	$7,437 23

FARMERS' INSTITUTE FUND.

Date.	War. No.	Name.	Dr.	Cr.
1907.				
Dec. 17......	....	To balance.........................	$596 84	
“ 18......	910	By National Paper Co...............	....	$8 60
“ 18......	911	C. D. Lyon......................	....	180 66
“ 18......	912	L. F. Childers...................	....	19 08
“ 18......	913	C. A. Willson....................	....	10 97
“ 18......	914	H. D. Hughes...................	....	5 50
“ 18......	915	C. F. Marbut....................	....	25 00
“ 18......	916	H. J. Waters....................	....	16 97
“ 18......	917	H. D. Hughes...................	....	14 60
“ 18......	918	W. A. Bright....................	....	25 00

FARMERS' INSTITUTE FUND—Continued.

Date.	War. No.	Name.	Dr.	Cr.
1907.				
" 18	919	By S. H. Elkins		$55 00
" 18	920	E. A. Trowbridge		21 89
" 31		To requisition	$1,000 00	
1908.				
Jan. 7	921	By C. H. Eckles		36 84
" 7	922	F. B. Mumford		12 37
" 7	923	J. C. Whitten		27 39
" 7	924	J. W. Connaway		40 32
" 7	925	Columbia Statesman		10 00
" 7	926	S. M. Jordan		204 77
" 7	927	L. Haseman		8 89
" 7	928	W. C. Hutchison		12 50
" 7	929	J. B. Rector		20 00
" 7	930	J. W. Boles		10 65
" 7	931	T. S. Gordon		17 50
" 7	932	Missouri Farmer		45 00
" 7	933	W. J. Kennedy		17 25
" 7	934	T. S. Gordon		15 50
" 7	935	Wayne Dinsmore		17 15
" 7	936	Sanford McSmith		12 50
" 7	937	W. D. Gose		7 50
" 7	938	D. A. Gaumnitz		52 15
" 7	939	P. E. Crabtree		54 40
" 7	940	M. F. Miller		75 14
" 7	941	L. B. Clore		29 90
" 7	942	E. Davenport		20 85
" 7	943	J. W. Sanborn		76 65
Feb. 1	944	E. B. Crain		10 00
" 1	945	Arch Riebel		9 00
" 1	946	Henry Ohlendorf		8 00
" 1	947	F. M. Riebel		7 00
" 1	948	Albert Johnmyer		6 00
" 1	949	Earl Clayton		10 00
" 1	950	Irl W. White		9 00
" 1	951	Frank A. Currie		8 00
" 1	952	Adolph Wasel		7 00
" 1	953	Robt. Marryman		6 00
" 1	954	N. H. Gentry		9 00
" 1	955	Edna D. Day		66 30
" 1	956	E. E. Laughlin		11 90
" 1	957	F. G. King		10 11
" 1	958	D. Ward King		52 26
" 1	959	S. M. Jordan		125 00
" 1		To requisition	500 00	
" 1	960	By John Eames		20 00
Mar. 2	961	L. Haseman		7 84
" 2	962	Columbia Statesman		8 50
" 2	963	W. J. Fraser		20 99
" 2	964	S. M. Jordan		202 27
" 2	965	P. E. Crabtree		93 07
" 2	966	F. G. King		11 70
" 2	967	W. L. Howard		17 99
" 2	968	C. O. Raine		84 88
" 2		To requisition	500 00	
" 27	969	By M. F. Miller		4 25
" 27	970	Columbia Statesman		1 25
" 27	971	E. A. Trowbridge		20 63
" 27	972	C. H. Eckles		20 88
" 27	973	L. F. Childers		17 27
" 27	974	Barnes-Crosby Co		15 00
" 27	975	J. C. Whitten		20 38
" 27	976	Barnes-Crosby Co		13 50

FARMERS' INSTITUTE FUND—Continued.

Date.	War. No.	Name.	Dr.	Cr.
1907.				
May 1	977	By Columbia Statesman		$35 00
" 1	978	J. W. Connaway		21 28
" 1	979	S. M. Jordan		14 85
" 1	980	Barnes-Crosby Co		10 87
" 1	981	Barnes-Crosby Co		8 13
" 27	982	Herring-Hall-Marvin Safe Co		20 00
" 27	983	Barnes-Crosby Co		20 37
Aug. 6	984	National Paper Co		12 90
" 31	985	S. H. Elkins		60 00
" 31	986	W. H. Chandler		8 09
" 31	987	Geo. B. Ellis		14 69
" 31	988	F. G. King		23 89
Sept. 2	989	S. H. Elkins		10 00
" 4	990	F. G. King		47 17
" 17	991	F. B. Mumford		10 77
" 24	992	S. H. Elkins		10 00
Oct. 2	993	R. L. Liddil		4 15
" 2	994	C. H. Eckles		7 74
" 2	995	American Express Co		26 75
" 2	996	F. G. King		17 68
" 2	997	Columbia Telephone Co		3 80
" 2	998	E. A. Trowbridge		10 54
" 2	999	W. L. Nelson		15 56
" 2	1000	S. M. Jordan		217 12
" 2	1001	S. H. Elkins		30 00
" 2		To requisition	$1,000 00	
" 31	1002	By C. H. Eckles		34 40
" 31	1003	W. L. Nelson		27 04
" 31	1004	M. F. Miller		12 50
" 31	1005	S. H. Elkins		30 00
" 31	1006	Paul Laughlin		2 50
" 31	1007	Roy C. Baker		2 50
" 31	1008	F. G. King		60 09
" 31	1009	S. M. Jordan		150 00
Nov. 6	1010	S. M. Jordan		48 30
" 6	1011	Geo. W. Williams		80 88
" 21	1012	F. H. Hillman		50 00
Dec. 1	1013	F. G. King		44 97
" 1	1014	Geo. B. Ellis		30 23
" 1	1015	S. M. Jordan		209 03
" 1	1016	W. A. Bright		35 00
" 1	1017	C. B. Hutchison		30 19
" 1	1018	W. L.Nelson		8 40
" 1	1019	M. W. Jones		6 50
" 1	1020	F. H. Hillman		3 15
" 1	1021	M. F. Miller		18 31
" 1	1022	W. H. Adams		2 00
" 1	1023	D. Ward King		96 54
" 1	1024	A. S. Prather		70 64
" 1	1025	A. J. McDowell		20 66
" 1	1026	M. F. Miller		31 05
" 1	1027	M. F. Miller		20 00
" 1	1028	S. H. Elkins		30 00
" 1	1029	Mo. Corn Growers' Ass'n		235 00
" 1		To requisition	2,000 00	
" 1	1030	By H. D. Hughes		35 67
" 15		By balance		1,366 48
			$5,596 84	$5,596 84

STATE VETERINARY FUND.

Date.	War. No.	Name.	Dr.	Cr.
1907.				
Dec. 17		To balance	$363 18	
" 18	2026	By S. Sheldon		$49 83
" 18	2027	J. E. Taylor		66 50
" 18	2028	Hatton & Knight		6 00
" 18	2029	R. P. Poage		20 00
" 18	2030	T. E. White		17 70
" 18	2031	W. A. Bright		35 00
" 18	2032	S. H. Elkins		30 00
" 31		To requisition	1,000 00	
1908.				
Jan. 7	2033	By E. M. Marten		50 00
" 7	2034	L. D. Brown		41 13
" 7	2035	E. M. Hendy		17 07
" 7	2036	R. B. Love		31 00
" 7	2037	H. V. Goode		15 00
" 7	2038	R. C. Moore		65 75
" 7	2039	Horace Bradley		29 70
" 7	2040	Columbia Statesman		5 00
" 7	2041	D. F. Luckey		218 66
" 7	2042	Columbia Telephone Co		3 68
Feb. 1	2043	D. F. Luckey		205 80
" 1	2044	E. M. Marten		50 00
" 1	2045	J. H. Slater		32 37
" 1	2046	R. C. Moore		77 50
" 1	2047	University Co-op. store		3 60
" 1	2048	Count Harvey		11 15
" 1	2049	L. D. Brown		88 30
" 1		To requisition	1,000 00	
Mar. 2	2050	By D. F. Luckey		252 40
" 2	2051	Count Harvey		7 80
" 2	2052	E. M. Marten		50 00
" 2	2053	T. E. White		11 25
" 2	2054	R. C. Moore		60 00
" 2	2055	H. F. Boettner		33 25
" 2	2056	S. H. Elkins		20 00
" 2	2057	Hatton & Knight		12 00
" 2	2058	H. V. Goode		54 90
" 2	2059	Horace Bradley		14 74
" 2	2060	R. B. Love		32 02
" 2	2061	Columbia Telephone Co		9 00
" 27	2062	E. M. Hendy		21 45
" 27	2063	University Co-op. store		3 60
" 27	2064	Columbia Telephone Co		4 30
" 27	2065	L. D. Brown		52 55
" 27	2066	H. H. Wolf		8 25
" 27	2067	R. P. Poage		50 00
" 27	2068	E. M. Marten		50 00
" 27	2069	Count Harvey		9 00
" 27	2070	D. F. Luckey		204 96
" 27		To requisition	500 00	
May 1	2071	By E. Brainerd		8 84
" 1	2072	Horace Bradley		35 58
" 1	2073	W. F. Berry		110 00
" 1	2074	Stanley Smith		28 12
" 1	2075	W. E. Dabbs		137 25
" 1	2076	R. C. Moore		18 70
" 1	2077	J. H. Slater		4 00
" 1	2078	F. W. O'Brien		7 08
" 1	2079	Jas. Cullison		6 10
" 1	2080	C. E. Steel		80 32
" 1	2081	L. D. Brown		29 23
" 1	2082	American Express Co		1 45

STATE VETERINARY FUND—Continued.

Date.	War. No.	Name.	Dr.	Cr.
1908.				
May 1	2083	By E. M. Marten		$50 00
" 1	2084	D. F. Luckey		233 49
" 1	2085	L. G. Clark		8 06
" 1	2086	R. C. Moore		37 70
" 1	2087	L. D. Brown		53 57
" 1	2088	S. McSmith		13 50
" 1	2089	J. L. Christian		20 00
" 1	2090	W. C. Hutchison		18 22
" 1	2091	A. M. Thompson		7 30
" 1	2092	W. C. Howell		12 35
" 1	2093	John Deerwester		7 80
" 1	2094	R. A. Young		23 00
" 1	2095	N. J. Colman		11 50
" 1	2096	N. H. Gentry		3 00
" 1	2097	H. J. Waters		6 39
" 1	2098	W. B. McRoberts		12 00
" 1	2099	J. W. Boles		8 50
" 1	2100	W. R. Wilkinson		10 87
" 1	2101	Geo. B. Ellis		5 64
" 1	2102	H. A. Gass		3 52
" 1	2103	E. E. Swink		18 60
" 1	2104	A. T. Nelson		19 10
" 27	2105	Columbia Statesman		19 50
" 27	2106	Herring-Hall-Marvin Co		20 00
" 27	2107	H. C. Tuck		178 30
" 27	2108	L. G. Clark		8 02
" 27	2109	Lee Gilbert		37 50
" 27	2110	J. W. Waller		6 00
" 27	2111	D. F. Luckey		212 78
" 27	2112	Blees-Moore Inst. Co		12 35
" 27	2113	H. C. Tuck		100 00
" 27	2114	S. H. Elkins		20 92
" 27	2115	Jas. Cullison		5 00
" 27	2116	E. M. Hendy		18 17
" 27		To requisition	$1,500 00	
" 27	2117	By J. E. Taylor		24 00
" 27	2118	A. J. Hammerstein		5 00
June 24	2119	R. P. Scurlock		7 97
July 1	2120	Lee Gilbert		50 00
" 1	2121	Smith Premier Co		27 31
" 1	2122	Jas. Cullison		41 19
" 1	2123	L. D. Brown		32 50
" 1	2124	J. E. Taylor		27 00
" 1	2125	Columbia Telephone Co		4 65
" 1	2126	H. Bradley		14 92
" 1	2127	J. H. Slater		14 20
" 1	2128	Hatton & Knight		6 00
" 1	2129	H. C. Tuck		57 87
" 1	2130	R. C. Moore		55 00
" 1	2131	C. E. Steel		129 78
" 1	2132	S. H. Elkins		15 00
" 1	2133	R. C. Moore		60 00
" 1	2134	L. G. Clark		11 00
" 1	2135	D. F. Luckey		246 93
" 1	2136	L. D. Brown		176 09
" 1		To requisition	1,000 00	
" 1	2137	By H. C. Tuck		198 80
" 1	2138	H. Bradley		29 21
" 1	2139	J. H. Slater		11 46
Aug. 1		To requisition	1,000 00	
" 6	2140	By W. B. Welch		14 00
" 6	2141	Columbia Statesman		13 50

STATE VETERINARY FUND—Continued.

Date.	War. No.	Name.	Dr.	Cr.
1908.				
Aug. 6	2142	By H. R. Varnon		$13 73
" 6	2143	L. G. Clark		8 65
" 6	2144	E. M. Hendy		8 00
" 6	2145	R. J. Mitchell		25 02
" 6	2146	Jas. Cullison		8 25
" 6	2147	Lee Gilbert		50 00
" 6	2148	C. E. Steel		25 09
" 6	2149	National Paper Co.		12 90
" 6	2150	A. J. Hammerstein		25 00
" 6	2151	L. D. Brown		190 88
" 6	2152	H. C. Tuck		185 11
" 6	2153	J. E. Taylor		42 00
" 6	2154	Columbia Telephone Co.		10 25
" 6	2155	R. C. Moore		59 10
" 6	2156	A. J. Hammerstein		50 00
" 6	2157	Smith Premier Co.		3 45
" 6	2158	D. F. Luckey		278 21
" 6	2159	Columbia Statesman		3 50
" 6	2160	M. H. Lamb		50 00
" 31		To requisition	$1,000 00	
Sept. 4	2161	By Western Union Co.		1 65
" 4	2162	Lee Gilbert		50 00
" 4	2163	C. E. Steel		21 50
" 4	2164	D. F. Luckey		219 19
" 4	2165	H. F. Boettner		30 37
" 4	2166	R. C. Moore		25 00
" 4	2167	T. E. White		13 18
" 4	2168	J. H. Slater		13 94
" 4	2169	L. D. Brown		195 55
" 4	2170	E. M. Hendy		39 75
" 4	2171	H. C. Tuck		203 60
" 4	2172	S. H. Elkins		20 00
" 4	2173	Jas. Cullison		8 50
" 4	2174	S. H. Elkins		100 00
Oct. 2	2175	Lee Gilbert		50 00
" 2	2176	A. C. Donohew		15 00
" 2	2177	H. Bradley		58 60
" 2	2178	R. P. Poage		8 50
" 2	2179	L. G. Clark		15 58
" 2	2180	A. J. Hammerstein		55 00
" 2	2181	J. E. Taylor		126 40
" 2	2182	H. Bradley		18 29
" 2	2183	L. D. Brown		188 31
" 2	2184	Jas. Cullison		9 00
" 2	2185	Pacific Express Co.		37 92
" 2	2186	H. F. Boettner		37 98
" 2	2187	R. C. Moore		42 50
" 2	2188	D. F. Luckey		264 47
" 2		To requisition	1,500 00	
" 2	2189	By H. C. Tuck		197 65
" 2	2190	Columbia Statesman		5 00
" 10	2191	Columbia Statesman		13 45
" 31	2192	L. G. Clark		8 70
" 31	2193	T. E. White		17 70
" 31	2194	Barnes-Crosby Co.		5 52
" 31	2195	Lee Gilbert		50 00
" 31	2196	J. E. Taylor		107 99
" 31	2197	Stanley Smith		10 44
" 31	2198	R. J. Mitchell		6 64
" 31	2199	A. J. Hammerstein		10 00
" 31	2200	A. J. Munn		4 80
" 31	2201	S. H. Elkins		30 00

STATE VETERINARY FUND—Continued.

Date.	War. No.	Name.	Dr.	Cr.
1908.				
Oct. 31	2202	By L. D. Brown		$100 00
“ 31	2203	H. C. Tuck		100 00
“ 31		To requisition	$1,000 00	
Nov. 6	2204	By. R. C. Moore		76 40
“ 6	2205	H. H. Wolf		8 35
“ 6	2206	L. D. Brown		105 97
“ 6	2207	H. C. Tuck		98 15
“ 6	2208	D. F. Luckey		196 54
“ 6	2209	R. B. Tilley		7 08
Dec. 1	2210	Columbia Statesman		45 00
“ 1	2211	W. F. Berry		22 00
“ 1	2212	J. H. Slater		7 73
“ 1	2213	Lee Gilbert		50 00
“ 1	2214	W. A. Bright		30 00
“ 1	2215	Hatton & Knight		12 00
“ 1	2216	R. P. Scurlock		4 40
“ 1	2217	J. E. Taylor		114 57
“ 1	2218	L. G. Clark		8 60
“ 1	2219	A. J. Hammerstein		37 55
“ 1	2220	W. B. Welch		16 50
“ 1	2221	R. C. Moore		52 50
“ 1	2222	L. D. Brown		162 53
“ 1	2223	S. H. Elkins		5 70
“ 1	2224	D. F. Luckey		174 33
“ 9		To requisition	615 26	
“ 15		By balance		600 82
			$10,478 44	$10,478 44

KANSAS CITY INTERSTATE FAIR FUND.

Date.	War. No.	Name.	Dr..	Cr.
1907.				
Dec. 17		To balance	$298 55	
“ 18	98	By W. A. Bright		$15 00
1908.				
Jan. 7	99	S. H. Elkins		35 00
Feb. 1	100	H. C. Crain		4 90
“ 1	101	F. M. Riebel		4 68
“ 1	102	E. L. Newton		4 44
“ 1	103	J. C. Wigginton		4 39
“ 1	104	H. T. Mackey		4 36
“ 1	105	W. C. Watson		4 18
“ 1	106	O. A. Barnes		4 18
“ 1	107	Edw. Easley		4 03
“ 1	108	D. A. Hudson		3 94
“ 1	109	C. A. Haynes		3 89
“ 1	110	H. C. Agin		3 83
“ 1	111	Whitten Hardware Co		3 78
“ 1	112	Eli Oyer		3 66
“ 1	113	J. C. Currie		3 66
“ 1	114	Clayton Scott		3 62
“ 1	115	D. C. Lentley		3 52
“ 1	116	L. P. Chapman		3 52
“ 1	117	J. E. Matheny		4 03
“ 1	118	C. E. Scott		3 35
“ 1	119	C. A. Haynes		2 89
“ 1	120	E. L. Hughes		3 83
“ 1	121	H. B. Hughes		3 00

KANSAS CITY INTERSTATE FAIR FUND—Continued.

Date.	War. No.	Name.	Dr.	Cr.
Feb. 1	122	By J. I. Mansur		$2 00
" 1	123	H. R. Scott		3 52
" 1	124	C. A. Griesnauer		3 25
" 1	125	Geo. H. Sly		3 66
" 1	126	Wm. Johnmeyer		1 04
" 1	127	Chris Smith		85
" 1	128	Rollin Crain		10 00
" 1	129	Paul Crain		9 00
" 1	130	C. J. Currie		8 00
" 1	131	Vincent Bondrean		7 00
" 1	132	Geo. Ohlendorf		6 00
" 1	133	Clark Riebel		5 00
" 1	134	J. E. Shirky		4 00
" 1	135	Walter Ohlendorf		3 00
" 1	136	Fred Ohlendorf		2 00
" 1	137	J. Lee Craigmile		1 00
" 1	138	Chester Matheny		10 00
" 1	139	Herbert Prettyman		9 00
" 1	140	Chalmer Clayton		8 00
" 1	141	Raymond Wasel		7 00
" 1	142	C. J. Currie		6 00
" 1	143	Clark Riebel		5 00
" 1	144	Robt. Mantzel		4 00
" 1	145	H. W. Smith		3 00
" 1	146	Claude L. Bryant		2 00
" 1	147	Gene Williams		1 00
" 1	148	S. H. Elkins		38 55
Oct. 2	149	I. T. Van Note		39 00
" 6		To requisition	$39 00	
			$337 55	$337 55

SUMMARY OF SECRETARY'S FINANCIAL STATEMENT.

EXPENSE OF MEMBERS FUND.

Date.		Dr.	Cr.
December 17, 1907	To balance in State Treasury	$500 00	
December 17, 1907	To balance in Treasury, Board of Agriculture''	314 58	
December 17, 1907, to December 15, 1908.	By warrants drawn on Treasurer Board of Agriculture		$520 28
December 15, 1908	By balance treasury, Board of Agriculture		294 30
		$814 58	$814 58

MONTHLY CROP REPORT FUND.

Date.		Dr.	Cr.
December 17, 1907	To balance in State Treasury	$1,500 00	
December 17, 1907	To balance in treasury, Board of Agriculture	104 31	
December 17, 1907, to December 15, 1908.	By warrants drawn on Treasurer Board of Agriculture		$657 84
December 15, 1908	By balance treasury, Board of Agriculture		146 47
December 15, 1908	7By balance State Treasury		800 00
		$1,604 31	$1,604 31

FARMERS' INSTITUTE FUND.

Date.		Dr.	Cr.
December 17, 1907...	To balance in State Treasury................	$7,500 00	
December 17, 1907...	To balance treasury, Board of Agriculture...	596 84	
December 17, 1907, to December 15, 1908.	By warrants drawn on Treasurer Board of Agriculture...........................	....	$4,230 36
December 15, 1908...	By balance treasury, Board of Agriculture...	....	1,366 48
December 15, 1908...	7By balance State Treasury................	....	2,500 00
		$8,096 84	$8,096 84

OFFICE EXPENSE FUND.

Date.		Dr.	Cr.
December 17, 1907...	To balance State Treasury..................	$500 00	
December 17, 1907...	To balance treasury, Board of Agriculture....	137 34	
December 17, 1907, to December 15, 1908.	By warrants drawn on Treasurer, Board of Agriculture...........................	....	$538 02
December 15, 1908...	By balance treasury Board of Agriculture....	....	99 32
		$637 34	$637 34

STATE VETERINARY FUND.

Date.		Dr.	Cr.
December 17, 1907...	To balance State Treasury..................	$10,200 00	
December 17, 1907...	To balance treasury, Board of Agriculture....	363 18	
December 17, 1907, to December 15, 1908.	By warrants drawn on Treasurer Board of Agriculture...........................	....	$9,877 62
December 15, 1908...	By balance treasury, Board of Agriculture...	....	600 82
December 15, 1908...	By amount paid for printing Bulletin, Vol. 6, No. 10, account with Printing Commission.	....	84 74
		$10,563 18	$10,563 18

STATE HIGHWAY ENGINEER FUND.

Date.		Dr.	Cr.
December 17, 1907...	To balance State Treasury..................	$10,000 00	
December 17, 1907...	To balance treasury Board of Agriculture.....	437 23	
December 17, 1907, to December 15, 1908.	By warrants drawn on Treasurer Board of Agriculture...........................	....	$6,791 72
December 15, 1908...	By balance treasury, Board of Agriculture.	....	645 51
December 15, 1908...	7By balance State Treasury..............	....	3,000 00
		$10,437 23	$10,437 23

APIARY INSPECTION FUND.

Date.		Dr.	Cr.
December 17, 1907...	To balance State Treasury..................	$1,000 00	
December 17, 1907...	To balance treasury, Board of Agriculture.....	225 75	
December 17, 1907, to December 15, 1908.	By warrants drawn on Treasurer Board of Agriculture...........................	....	$1,154 16
December 15, 1908...	By balance treasury, Board of Agriculture...	....	71 59
		$1,225 75	$1,225 75

KANSAS CITY INTERSTATE FAIR FUND.

Date.		Dr.	Cr.
December 17, 1907...	To balance State Treasury..................	$1,000 00	
December 17, 1907...	To balance treasury, Board of Agriculture.....	298 55	
December 17, 1907, to December 15, 1908.	By warrants drawn on Treasurer Board of Agriculture...........................	....	$337 55
December 15, 1908...	By balance State Treasury.................	....	961 00
		$1,298 55	$1,298 55

PRINTING AND DISTRIBUTING ANNUAL REPORT FUND.

Date.		Dr.	Cr.
December 17, 1907...	To balance State Treasury..................	$4,026 37	
December 17, 1907...	To balance treasury, Board of Agriculture.....	103 76	
December 17, 1907, to December 15, 1908.	By warrants drawn on Treasurer Board of Agriculture........................	....	$482 19
December 15, 1908...	By balance State Treasury...............	....	3,647 94
		$4,130 13	$4,130 13

The amounts paid for printing bulletins and the annual report are allowed by the State Printing Commission, and the moneys for that purpose are not drawn by the treasurer of the Board of Agriculture; hence the exact balances will be the amount charged for printing less than the above figures.

Respectfully submitted,

GEO. B. ELLIS, Secretary.

TREASURER'S REPORT.

To the State Board of Agriculture:

I, W. A. Bright, Treasurer of the Board of Agriculture, submit the following report of the amount of money from last statement, and received from the State Treasurer, including balances, and the amounts paid out on warrants presented against the several funds of the Board of Agriculture, and the balances now on hand, all for the year ending December the 12th, 1908.

PRINTING ANNUAL REPORT FUND.

Date.		Dr.	Cr.
1907.			
December 10	To balance, transferred from last statement	$103 67	
1908.			
January 3	To State warrant	300 00	
October 7	State warrant	78 43	
December 12	Overdraft	10	
December 12	By warrants paid and cancelled		$482 20
		$482 20	$482 20

MONTHLY CROP REPORT FUND.

Date.		Dr.	Cr.
1907.			
December 10	To balance from last statement	$104 32	
1908.			
March 4	State warrant	100 00	
May 4	State warrant	100 00	
June 6	State warrant	100 00	
September 2	State warrant	200 00	
November 7	State warrant	200 00	
December 12	By warrants paid and cancelled		$657 85
December 12	balance		146 47
		$804 32	$804 32

EXPENSE OF MEMBERS FUND.

Date.		Dr.	Cr.
1907.			
December 6	To balance from last statement	$314 59	
1908.			
March 4	State warrant	200 00	
August 4	State warrant	100 00	
December 7	State warrant	200 00	
December 12	By warrants paid and cancelled		$520 29
December 12	balance		294 30
		$814 59	$814 59

STATE VETERINARY FUND.

Date.		Dr.	Cr.
1907.			
December 13	To balance from last statement	$508 56	
1908.			
January 4	State warrant	1,000 00	
February 4	State warrant	1,000 00	
April 8	State warrant	500 00	
June 3	State warrant	1,500 00	
July 5	State warrant	1,000 00	
August 4	State warrant	1,000 00	
Sept. 2	State warrant	1,000 00	
October 7	State warrant	1,500 00	
November 4	State warrant	1,000 00	
December 12	State warrant	615 26	
December 12	By warrants paid and cancelled		$10,023 00
December 12	balance		600 82
		$10,623 82	$10,623 82

FARMERS' INSTITUTE FUND.

Date.		Dr.	Cr.
1907.			
December 13	To balance from last statement	$634 91	
1908.			
January 4	State warrant	1,000 00	
February 4	State warrant	500 00	
March 4	State warrant	500 00	
October 7	State warrant	1,000 00	
December 7	State warrant	2,000 00	
December 12	By warrants paid and cancelled		$4,116 08
December 12	balance		1,518 83
		$5,634 91	$5,634 91

STATE HIGHWAY ENGINEER FUND.

Date.		Dr.	Cr.
1907.			
December 10	To balance from last statement	$469 63	
1908.			
January 16	State warrant	1,000 00	
March 4	State warrant	1,000 00	
May 4	State warrant	1,000 00	
June 3	State warrant	1,000 00	
September 2	State warrant	1,000 00	
October 7	State warrant	1,000 00	
December 7	State warrant	1,000 00	
December 12	By warrants paid and cancelled		$6,824 12
December 12	balance		645 51
		$7,469 63	$7,469 63

OFFICE EXPENSE FUND.

Date.		Dr.	Cr.
1907.			
December 11	To balance from last statement	$137 35	
1908.			
May 4	State warrant	100 00	
June 3	State warrant	100 00	
August 4	State warrant	100 00	
October 12	State warrant	100 00	
November 4	State warrant	100 00	
December 12	By warrants paid and cancelled		$538 03
December 12	balance		99 32
		$637 35	$637 35

APIARY INSPECTION FUND.

Date.		Dr.	Cr.
December 10	To balance from last statement	$225 75	
1908.			
June 3	State warrant	500 00	
September 2	State warrant	500 00	
December 12	By warrants paid and cancelled		$1,154 16
December 12	balance		71 59
		$1,225 75	$1,225 75

KANSAS CITY INTERSTATE FAIR FUND.

Date.		Dr.	Cr.
1907.			
December 13	To balance from last statement	$332 05	
1908.			
October 12	State warrant	39 00	
December 12	By warrants paid and cancelled		$371 05
		$371 05	$371 05

Respectfully submitted,
W. A. Bright, Treasurer.

REPORT OF STATE HIGHWAY ENGINEER.

Columbia, Mo., Dec. 15th, 1908.

To the Honorable Members of the State Board of Agriculture:

Gentlemen—Looking back over the season's work, a decided improvement is evident all along the line. Many things can still be seen which might be improved upon and many more which should be improved upon where the conditions will not permit. No man's foresight is so good as his back-sight, for it is only by the past that we can judge the future. The best results are to be obtained from a study of the scrap pile. Road officials are therefore advised to look back over the season's work and to study the scrap heap.

Reviewing the past year's work of the State Highway Department, I find that the Department's representatives have visited about 100 separate localities for the purpose of attending meetings, making road addresses, or for investigating and giving advice upon road and bridge matters. Few hard surfaced roads have been made under our supervision, the greater number of our calls being for consultation upon earth roads, culverts or bridges. The Department has sent out 15 steel bridge plans, aggregating 2,600 linear feet of bridging at an estimated cost of $37,000.00; 72 concrete bridge and culvert plans aggregating about 760 lin. feet of bridging at an estimated cost of $25,000.00. A total aggregate of 87 structures—3,360 lin. feet and $62,000.00 cost. These plans were made for and upon request of the County Highway Engineers, and about 25 per cent have been contracted for and built.

At the instigation of the State Department, the county engineers have formed a highway engineers' association of the State, the object and purpose being to secure uniformity of methods, the establishment of closer relations and the advancement of knowledge pertaining to road building and maintenance among the county engineers.

We gave all aid possible to the road overseers' schools of instruction, and I am convinced that the law requiring that all overseers of a county be called together for instructions at the county seat by the county engineer, at least once a year, is one of the best features of our new road laws.

The machinery for testing road materials was purchased last spring, but has only recently been installed in the engineering building of the State University. We are now prepared to test any kind of road or bridge material which may be sent in by the county officials, at no expense to them save for the shipment of the materials to Columbia.

The road exhibit put on by the highway department at the State Fair last October was creditable, and consisted of road tools and machinery and models and structures in concrete and steel.

In my report last year I advocated the use of some of the State convicts upon the public roads, which advocacy I wish to renew. I do not advocate scattering the convicts out along a road, but would keep them confined strictly to quarrying and crushing, leaving the hauling and other work necessary to the completion of the road to be performed by the community for which the road is being made. With a systematic order of distribution and application for such work, much assistance can be given in the form of State aid to road work. Road material of average quality is accessible in almost every county of the State, and in a number of counties it can be found within reasonable hauling distance of any road. I would have the State own portable outfits for quarrying and crushing, with an average output of about 100 c. y. per outfit per day, to be manned by State convicts. A steel cage mounted on wheels with bunks, which could be lowered and raised on the plan of Pullman coach, could be purchased to accommodate 16 or 18 men. With crusher, cook and guard outfits on separate trucks, the whole could be transported to the railroad, shipped to the next place where wanted, and again hauled out to the road or quarry. This quarrying and crushing should be in some form of State aid, the county or road district having done the grading necessary to prepare the road-bed for receiving the rock and also having made arrangements to put on the rock after it is crushed for them.

I beg to call attention to Greene county, Missouri, where the road officials have this year succeeded in putting out a convict rock crushing outfit with county prisoners exactly like the plan I have outlined. The county convict outfit consists of a traction engine, the convict cage, cooking tent and guard outfit. The crew of a team, two guards, an engineer and 12 prisoners with an output of about 80 c. y's. per day at a cost to the county of about $15.00 per day. The convict outfit does only the crushing, the road district doing everything else. So successful has it proven that the demand for it from different districts is great enough that two or three such outfits could be kept busy. The cost to the county is so small that the taxes on the increased valuation of property caused by the improvement will pay the county a good interest upon the capital invested.

The work of a large number of our county highway engineers cannot be too highly praised. In some counties it has required the man to be philosopher, orator, politician, economist and engineer. It has been a hard position to fill, and even with a discouraging season the roads have been improved. The haphazard way of attending to the road interests is fast disappearing, and is superceded by order and system under the supervision of the county highway engineer. There is a saving in handling and buying tools, implements and materials; there is better and more permanent work and better maintenance. More hedges are trimmed, more poll-tax collected, and men and teams are worked to better advantage. Small things, as opening ditches, placing culverts in the right place or abandoning others, putting fences on the established lines or clearing the right of way of obstacles have been attended to. Many things which any sensible man knows how to do, have never before been done simply because there was nobody whose business it was to do them. This is the result of supervision, and in every county where it has had a fair, honest trial the results are good.

The roads of the State have been gradually improving for years along with the natural growth and progress. But the year just past shows more advance and improvement in the roads than any other one year. With the plans already made by the county engineers for next year's work the end of another year will see the most decided advancement in road improvement that has been seen in any other one year. The efforts of the State highway department shall be for the improvement of the roads as a system and not for an isolated road here and there. In order to accomplish this, it is necessary:

1st. To give whatever assistance we can to any place or community showing a spirit for improvement and a desire to improve. In this way we give aid to the isolated road because it is a part of the road system and all cannot be improved at one and the same time.

2nd. To have road laws which can and will be complied with. Our present laws are good, but need to be made consistent in a few inconsistent minor points. Because there has never, until this year, been anyone whose business it was to see that the road laws were enforced, the average citizen has not respected them, but has felt at liberty to ignore them.

3rd. To obtain uniformity in methods and a system of work, and in keeping records. Records of contracts and of the roads themselves have been kept in a very careless manner, if kept at all. We find there is no record of at least one-half of our public roads, and some of the records which are found could have but little standing in the courts. One of the greatest disadvantages our engineers have in the enforcement of the road work is the lack of any record of the roads themselves.

4th. To give attention to the maintenance of the earth roads. Over 95 per cent of our roads are earth, and it will be some years before as much as 10 per cent of them will be anything more. Hard surfaced roads are too expensive to build and maintain to plan a very rapid progress in their construction. The largest mileage will, and should be, earth roads for a long time to come, and in the meantime the best should be made of them that the means and natural conditions permit.

5th. With this care of the earth road, attention must be given to the construction of good, substantial and permanent culverts and bridges. The highway department should be given more control over this feature of the work in order to prevent the substitution of unsuitable, unsubstantial or unsightly structures. Not so much to procure the structure at a less cost, but to obtain a suitable one, worth the price paid for it. As the roads improve the loads increase, and it is both safety and economy to build permanent bridges and culverts. Well maintained earth roads with good bridges and culverts is the solution for the majority of our road difficulties.

6th. Where the travel converges upon our main roads, making the traffic too heavy to maintain earth roads, they should be hard surfaced as fast as possible. These roads are of enough importance to justify the increased expenditure. This is another feature of our road work over which the State department should have more power of control. A road is not made by piling on the material in a haphazard way without attention to the foundation or drainage. Using more material than is necessary is another waste. Money is being wasted in all these ways in Missouri. It costs too much money to make good roads for the work to be done in a careless manner or without attention to the principles of road-building.

7th. Many people advocate expensive road building without a thought for maintenance. Any road will wear out and as soon as a road is built provisions should be made for maintaining it. Maintenance is second in importance to construction, and we must not lose sight of the fact that a good earth road is largely a question of maintenance. Before we can have a good system of roads, we must have a good maintenance system—a continuous maintenance. Our road district might be of a suitable size to own an outfit and employ a man to do nothing the year around but keep up the roads of that district. It is the most economical in the end and will eventually develop a class of men who make it their business. It will be their duty to care for the roads while other men are attending to their own particular line of business.

I wish, also, to do some research work or investigation this year, to begin as soon as I know what funds the department has for expenses.

1st. Demonstrate the use of the road drag for maintaining hard surfaced roads. I know that the drag properly used upon gravel roads will keep the surface smooth. It ought to do the same with roads surfaced with chats. I do not know what might be the result upon a macadam road, but I am arranging to give it a thorough trial in several places in the State.

2nd. Make a study and test of road material of the State, taking up those sections first which promise to need it first.

3rd. An investigation and census for the amount of travel; the kind and size of loads; date and length of time of heavy, wet roads; and the effect of bad roads upon public school attendance.

4th. Collect interesting and historical data concerning the old State roads opened years ago by the State. This is valuable from a historical standpoint only, but will soon all be lost—much of this history is gone beyond recovery now.

5th. Add a little each year to the State Fair road exhibit. It helps to keep up interest and is a feature for instruction upon road affairs.

6th. Make field and laboratory tests upon paints and preservatives for steel highway work. It is a feature of maintenance which has been neglected. Well directed attention to this question will mean several years added to the life of steel bridges.

Respectfully submitted,
CURTIS HILL,
State Highway Engineer.

Hinchey Pho

A LAWRENCE COUNTY ROAD.

REPORT OF THE STATE INSPECTOR OF APIARIES.

Mr. President and Gentlemen of the Board:

In presenting this, the second annual report of my work as Inspector of Apiaries, I wish to state that the work is yet largely a work of education, and will necessarily remain so for some time to come, for so few people understand and appreciate the real value of the honey bee to humanity and the necessity for guarding it against disease and harmful influences.

I will first refer to the work done during the past year, and then call your attention to a few suggestions which I think would greatly aid future work.

Total number of apiaries visited during the season of 1908.	340
Number of apiaries diseased	166
Total number of colonies inspected	5,155
Number of colonies diseased	469

Much more work has been done during the season just closed than in the one preceding.

During the season of 1908, 2,127 more colonies were inspected than during the season of 1907. Some localities are now pretty well cleansed of foul-brood, where two years ago we found disease widely spread, and the conditions favorable for the wholesale distribution of the infection. Work has been started in several new localities with gratifying results. Greater good could have been accomplished during the season just closed had the weather been more favorable in the spring and early summer. The cold, rainy, weather was not only hurtful to the bees, but it caused the work of inspection to proceed very slowly, this work having to be regulated by conditions that affect the bees, such as cool weather, rainy weather, and a scarcity of nectar to be gathered. Failing to observe these conditions would result in harm instead of good.

There is much territory that remains yet unvisited simply for the lack of time. I have reports from several new localities where disease is thought to be in existence. These places will be visited when the proper season comes for that work. I do not expect to find disease in each locality so reported, for the uninformed are often likely to be mistaken in their conclusions. If they find dead brood in their hives they are alarmed and at once report a case of foulbrood, but when investigated it frequently proves to be nothing but starved brood. A little honey or sugar syrup given at the right time would have saved them, and saved a trip for the inspector also.

People are not always to be blamed for these mistakes, especially where they have had no experience with bee disease. In such cases I take pains to explain the nature of bee disease and its treatment, so that next time they will know better how to diagnose the trouble. I find many who need instruction in the general care and management of bees, before they are capable of treating disease. I have tried to give such information as best I could in the limited time I had.

The work of the past two seasons has demonstrated the need of making provision for some additional work in this department:

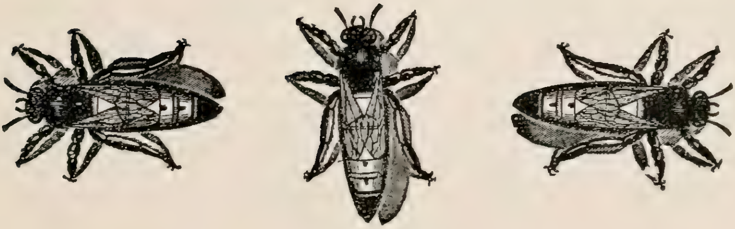
First—the inspector should be given the authority to appoint deputies to look after special work when, during his absence, he deems it necessary; so that diseased colonies will not remain untreated from the first visit until the second. Only a few days would be required for this special work, and it would greatly aid in the work of eradicating disease, and also enable the inspector to get over more territory.

Second—provision should be made so that the inspector's duties in the development and protecting of the industry, should cover the whole field of agriculture in such a manner that any work for the good of the industry could be taken up. This would make room for some experimental work which we have sadly felt the need during the past season. In the management and treatment of the trouble called "pickled brood," a trouble which in many respects closely resembles European foulbrood, it is difficult at times to tell just what treatment is best. This trouble has been very severe in some localities during the past season, almost wiping out of existence whole yards. Some cases were found where two troubles seemed to be working together. A few careful experiments would have told whether or not the trouble was of a contagious nature; then we could have applied the treatment more intelligently. By experimental work, I don't mean that the inspector should take up scientific work in bacteriology. It is the practical tests, by inoculation and otherwise, to determine the nature of the trouble that we want, so that we may know whether the disease under treatment in some certain locality is contagious or not.

Some careful investigations along the line of spraying during fruit-blooms would also be of value, for many do not understand the true relationship existing between bees and horticulture. Many do not understand the value of the bee as a pollen distributor, a work that is probably worth more to humanity than the crops of honey produced. Any work to educate the people along these lines will be well taken up, for this neglected branch of agriculture is one of the undeveloped resources of the State, which with the proper protection and encouragement will add largely to the State's wealth. The crops of honey and wax that are annually produced are worthy of our attention; yet these crops could easily be doubled, and that without increasing the present number of bees, if every owner of bees would give them the care and management they deserve. Then give this worthy cause the recognition that it deserves, and let it grow and continue to bless mankind in performing its double mission in life.

For treatment of bee diseases, see monthly bulletin, Vol. VI, No. 11.

Respectfully submitted,
M. E. DARBY,
State Apiary Inspector.



QUEEN BEES

REPORT OF STATE VETERINARIAN.

Mr. President and Gentlemen of the State Board of Agriculture:

A statement of all the official visits made by the State Veterinarian and deputy State Veterinarians has been tabulated by the Secretary of the Board and will be printed in your annual report. Reference to this statement will show that the principal part of the control work during the past year has been done by the deputies located in the different parts of the State. The work at the office has increased to such an extent that, if properly attended to, it would require all of my time. In addition to attending to office work during the past year, I have, however, devoted a large share of my time to making tuberculin tests of herds of cattle and studying the situation with regard to the spread of tuberculosis among cattle and hogs. I furthermore, took personal charge of the tick eradication work in South Missouri, and, altogether, devoted about two months of my time to this line of work. By way of educational work I put in three weeks at farmers' institutes and prepared a bulletin on the subject of "Parasitic Diseases of Sheep."

The continual traffic in live stock in this State tends to cause repeated outbreaks of contagious diseases. In order to keep these diseases under control, it is necessary to keep up a running fight against them. The funds provided for the veterinary department have heretofore been entirely inadequate. On account of the lack of funds we have had to neglect many outbreaks of diseases during the last year and have been compelled to make hasty and incomplete investigations in others. However, with the exception of the rapid introduction and spread of tuberculosis in our herds, and the extension of the losses from Texas fever, we have done fairly well in our efforts to hold all contagious diseases in check.

SCABIES.

During the year 1908 there were 53 shipments of scabby sheep from Missouri to the public markets. Other reports of outbreaks of scabies were received from different sources.

Up to July 1st, a deputy was sent to the point of origin of each of these shipments to investigate the extent of the outbreak and to quarantine all diseased sheep and the shipping pens. In some of these investigations scabies was found to be wide spread and its suppression required considerable time. On account of the veterinary funds running low, we had to discontinue this work on July 1st. Since that time, we have simply written the shipper a letter and sent a notice, through the mail, quarantining the railroad stock pens. We have no way of knowing whether or not the shipper or other owners of scabby sheep in the neighborhood paid any attention to the letter, or whether the railroad companies properly attended to the disinfection of their stock pens. To say the least, this is an unsatisfactory and loose method of handling a contagious disease that may do great damage to the sheep industry of the State.

FOOT ROT.

During the spring and summer, foot rot broke out in two bands of sheep in Chariton county. One of these contained 300 head, and the other 600 head. Before the owners were aware of the dangerous nature of this disease it had spread until more than 75 per cent of the sheep in each lot were affected. The treatment was slow and tedious, and even after its use these flocks were worth less than in the beginning. The source of infection seems to have been a lot of sheep shipped from Linn county, Mo., but no complaint has been received from that county. Both of the herds which were affected with foot rot were placed in quarantine and will be held until completely cured.

TEXAS FEVER.

The Texas fever spread over more territory during 1908, than in any previous year. The past winter was warm, thereby allowing the fever ticks to live through. There was a heavy crop of acorns in the timbered areas and, to save these, fire was kept out of the woods. The leaves protected the ticks and they have consequently been abundant in territory heretofore infested and have spread to new areas. There has been a heavy loss of cattle from Texas fever in Newton and McDonald counties. There was quite a severe loss in the neighborhood of Richards, Vernon county, which apparently resulted from the shipment of cattle from McDonald county. The movement of cattle from Newton, McDonald, Oregon and Ripley counties was more or less restricted by the Federal quarantine to the detriment of the cattle industry in these counties.

In past years we have attempted to control Texas fever by hunting up and quarantining all the ticky cattle. It was the custom to release such cattle from quarantine as soon as they were cleaned from the ticks, with the understanding that their owners should keep them clean. This method for several reasons failed to produce satisfactory results. It was impossible to locate and examine all the cattle at the times when the various crops of ticks were on them. It was difficult to enforce a quarantine. (In one case, the prosecuting attorney of Newton county advised an owner to turn the cattle out and ignore the quarantine). The re-examination of cattle for release from quarantine consumed too much of the inspector's time. It was often found, upon re-examination, that the owner had only partially cleaned his cattle of ticks, or that he had not done it at all. It was the rule rather than the exception that, when cattle were once released, the owner would neglect to keep them clean. The repeated examination of herds under observation, and the explanation of details to their owners, required so much time that the inspectors could not cover the ground. There were general complaints that it took too much work and expense to keep the cattle free of ticks, and, in some cases, it was claimed that the oil used damaged the cattle. In fact, every imaginable reason that could emanate from a lazy man's mind was advanced against the eradication of the Texas fever ticks.

To get around these various obstacles we set about at the beginning of the last season to carry out some more effective plans. We asked the U. S. Department of Agriculture, out of the tick eradication appropriation, to furnish a spraying outfit for each infested county in this State. Our request was granted as to outfits for Oregon, Newton and McDonald counties. The spraying outfits consisted of a wagon and team, two men and a supply of soap and crude oil, with which to make an emulsion that is the most effective agent known for the destruction of ticks. Arrangements were made to cover all the infested area every two weeks, if possible, and spray all the cattle. All the owners had to do was to get their cattle up in a convenient lot, upon receipt of a notice of the time that the spray wagon would be along. The State inspector, working in co-operation with the crew furnished by the U. S. Department of Agriculture, was instructed to attend to notifying cattle owners when to have their cattle up and to compel delinquents to fall in line. We sought to reach those who were averse to tick eradication by appealing to the statute which forbids an owner to allow "cattle infected with Texas fever to run at large." This statute authorizes the sheriff, under a warrant from the justice of the peace, to round up such diseased cattle, to hold them in quarantine at the expense of the owner, and, if necessary, to sell them to pay all fees and costs. Fortunately, it was necessary to invoke the law in the severest manner in only a few cases. In two cases in McDonald county the owners, after due notice in writing, allowed tickey cattle to run at large. A severe loss of cattle by death from Texas fever was generally credited to one of these herds. On presentation of the evidence in these cases, by Dr. H. C. Tuck, cattle inspector, the prosecuting attorney of McDonald county held that the law would not apply unless the cattle that spread the disease were themselves actually showing symptoms of the disease. This occurred towards the last of the tick season. The moral effect of this case will greatly hinder tick eradication work during the coming year. Unless the law is remedied so as to cover the cattle that carry the Texas fever ticks, whether or not they actually show the symptoms of the disease, we cannot hope to secure the best results in tick eradication work.

In one case in Newton county, an owner neglected to get his cattle up to be sprayed and allowed them to run at large, while they were constantly carrying and spreading Texas fever ticks. The necessary papers and notices were served on him and preparations made to have the county authorities round up the cattle and disinfect them. In this case, the sheriff ignored the justice of the peace order to round up the cattle and the prosecuting attorney failed to appear, or send an assistant, to attend to the prosecution of the owner. The case ended up by the owner giving bond to get his cattle up and keep them free from ticks. The moral effect of this case was not wholly lost.

To represent the State in tick eradication work, Mr. J. E. Taylor was appointed to act as inspector in Oregon county, Dr. L. D. Brown, regular deputy, was assigned to Newton county, and Dr. H. C. Tuck, regular deputy, to McDonald county. Owing to the lack of funds, the extent of the infestation, and the lack of co-operation in Ripley county, no eradication work was undertaken in that county this year. In Oregon county it was possible for the spray wagon to cover the infested territory with something approaching regularity, and the work was begun there early enough to promise good results. Practically all of the cattle in the infested areas in Oregon county were sprayed time after time from July until after frost. The burning off of the range was not as complete as it should have been, but, altogether, this county ought to be almost free from Texas fever ticks.

The spray wagons were started in Newton and McDonald counties in the latter part of August, entirely too late to get complete results. However, a great deal of good was accomplished. While the fever ticks were not completely cleaned out of these counties, something was accomplished towards that end and the spread of ticks to other counties was prevented. The eradication work in all of the tick infested counties ought to be started in April, 1909, and at least two more men added to the force. The law ought to be amended to make it a misdemeanor for an owner to allow his ticky cattle to run at large, after he has had due notice from an inspector. Without such a provision, there will be a partial waste of all time and money spent in tick eradication work.

GLANDERS.

During the year there were found 159 outbreaks of glanders. Every one of these was promptly investigated and controlled. As soon as any petititon or any other regular call was received, indicating an outbreak of glanders, an investigation was ordered, even in the most inaccessible parts of the State. Every animal found to be diseased with glanders was placed in quarantine, entirely away from other horses, and, in due course of time, was destroyed by a county officer. The owner was given written orders and directions for the disinfection of his premises. The number of outbreaks of glanders was as small as could be expected with the immense traffic of horses and mules into and through the State, continually going on, and the dangerous watering fountains still in use in Kansas City. Public sentiment has always been in favor of the eradication of glanders and suitable statutes are in force for their control. The results that have been obtained in controlling glanders, under conditions of trade that may be considered adverse, plainly illustrate what could be accomplished in the eradication of tuberculosis with proper public sentiment and the necessary law.

HOG CHOLERA.

Severe losses from hog cholera have continued during the last year. The total loss of hogs in this State since 1902 has been at least $10,000,000. Heretofore there have been no efficient means for controlling it. Fortunately, a method of immunization of hogs against cholera has been discovered, which, if properly applied, can be confidently relied upon to stop the disease. The serum for immunization purposes can be prepared at a very reasonable cost. This serum may be kept indefinitely. The supply ought to be placed in the hands of every deputy veterinarian in the State, so that quick action can be taken in case of any outbreak. By the owner of a herd of hogs notifying the secretary of the board of agriculture by telegram, and, he, in turn, promptly ordering a deputy veterinarian out by telegram, an outbreak of hog cholera can be taken charge of before there is time for it to spread. As a rule, the deputy veterinarian can be on the ground within twenty-four hours or sooner, after the owner makes up his mind to act. By simply giving the sound hogs in the herd an injection of the serum, requiring only a few moments of time for each hog, protection against cholera will be immediate and almost complete. Several hundred hogs can be thus injected by one veterinarian in a day. Those hogs which are injected with serum, before they show any symptoms of the disease will almost invariably remain well. Those that are found sick can be rounded up and either killed and burned or kept in a small pen and frequently saturated with an antiseptic in such manner as to prevent disease from spreading from them. In this way some hogs can be saved out of the diseased herd and the disease kept from spreading all over the neighborhood. By being in a position to attend to these outbreaks promptly all losses from hog cholera can be stopped and the disease stamped out of the State. If the cholera continues in the future, and there is no reason to doubt that it will, there will be ample opportunity, within the next twelve months, to save single counties more money on this one proposition than the entire state appropriation for the veterinary department for two years. This plan was recommended by Dr. A. D. Melvin, Chief United States Bureau of Animal Industry, at the last annual meeting of the Interstate Association of Live Stock Sanitary Boards and unanimously approved by that association.

FOOT AND MOUTH DISEASE.

Foot and Mouth disease has again appeared in several of the northern and eastern states. This disease is of such a nature that it can be stamped out only by killing and burning all of the diseased and exposed cattle. It is of such dreadful sequence as to make such a drastic course necessary. The law of this State is deficient in that it makes no provision, whatever, for controlling an outbreak of foot and mouth disease if one should occur. It is more or less accidental that the present outbreaks occured in other states instead of in Missouri. In view of the fact that the infection may spread into this State from points of infection now in other states, or an outbreak may occur at any future time from unknown sources, this department ought to be ready to take effective charge of an outbreak at any time. The law ought to be amended, as early as possible, to cover foot and mouth disease, and to provide for the disposition of affected cattle.

TUBERCULOSIS.

Tuberculosis is spreading rapidly among hogs and cattle in this State. The tuberculin tests during 1907 showed 4.5 per cent of the cattle tested to be tuberculous. The tests of 1908 showed 8 per cent to be tuberculous. These tests, although limited in number, seem to fairly represent the average condition among the permanent herds of the State. The increase in this State, as shown by these tests, has been in almost exact proportion to the increase in the number found tuberculous on post-mortem examination by Federal meat inspectors, which, in 1907, was 29,833 head, and in 1908, was 51,838 head. The total number of cattle coming under Federal meat inspection has increased 24 times as fast as the number inspected. These tuberculous cattle, through their milk and droppings, have been the principal source of infection among hogs.

While the total number of hogs inspected by the Federal government has increased only about one-half since 1900, the number found tuberculous has increased 160-fold. The number found tuberculous has increased 320 times as fast as the number inspected.

The increase in the prevalence of tuberculosis has been so great that the shipment of affected hogs and cattle from this State to the public markets is now a common thing, whereas such shipments were practically unknown only a few years ago. The tests of 1907 showed that many badly tuberculous herds were contributing to the general milk supply of the large cities. Tests in 1908 showed that tuberculous herds are plentiful around the smaller cities of the State. Tuberculosis is already so thoroughly scattered that it seems hardly possible that any creamery company or milk dealer in the State can be getting the supply of cream or milk which is not contaminated by the products from tuberculous herds.

On account of its great prevalence the work of stamping out tuberculosis among cattle will require well laid plans, several years' time, and the expenditure of a large amount of money. The longer the beginning is delayed the more time and money it will require to do the work. If eradication work is undertaken in the right manner and carried forward unhampered, we may reasonably expect to clean it out of the dairy herds within four or five years. At the beginning we must confine our principal efforts toward cleaning up the dairy herds. This is deemed advisable for several reasons. On account of the way in which they are handled tuberculosis is not apt to spread so rapidly among beef cattle. It does not reduce the value of beef cattle as much as it does dairy cattle. A tuberculous beef animal may be more profitably kept in quarantine for breeding purposes. Such an animal is used for breeding as long as it does not go down with the disease. The additional expense and trouble of thus keeping beef cattle in quarantine is not very great. Meat inspection and a thorough cooking of the meat protects the human family, from tuberculosis through beef cattle, almost altogether. The danger to the human family being largely eliminated, the losses from tuberculosis among beef cattle are confined principally to the matter of financial profits. Under present conditions, and until owners of beef herds show a disposition to co-operate with the State, the tuberculosis situation among beef cattle men will be left to take care of itself.

On the other hand, dairy cattle are, of necessity, kept confined and in close contact with one another. Many instances are at hand to show that, when a tuberculous animal is added to a dairy herd, the disease spreads among the cattle and ruins the herd in an incredibly short time. When a dairy cow is tuberculous she is practically worthless. She is no longer useful for milk and her carcass is worth very little for beef, even though it should be only slightly diseased and pass meat inspection. To keep the dairy cow in quarantine for breeding purposes will require a visit to a separate lot twice a day to feed and milk her. Her milk must be sterilized before it can be safely fed to calves and pigs. The only profit will be the calf. The additional expense and trouble of keeping her in quarantine is so great that the calf, even if from a registered cow, is seldom worth the while. Furthermore, the State is practically in its infancy in the dairy business. Hundreds of farmers are going into the dairy business every year. A large per cent of the newly founded herds are not yet tuberculous. In many herds the disease is still limited and can be stamped out at a small expense. It is absolutely essential that the beginners in the dairy business should start with sound herds, and that the State render every possible assistance in enabling them to do so. Every effort should be made to go through the herds that are slightly tuberculous to rid them of disease before it is too late. For the protection of the human family and other herds of cattle, those herds which are already rotten with tuberculosis should be put out of existence. Above all, the dairymen of this State are alive to the situation. They have shown a most commendable desire to co-operate with the State in the eradication of tuberculosis from their herds. They have shown a willingness to do everything in their power to protect the health of their own cattle, the reputation of the dairy industry, and the human family from one of the most prolific sources of infection of the Great White Plague.

A thorough study of the dairy situation in this State leads me to believe that the veterinary department should be provided with funds to employ capable men for the purpose of testing any dairy herd when requested to do so by its owner. It is plainly the duty of the State, when such work is carried on for the public good, to pay a part of the loss on account of cattle that are found diseased and condemned. The law of the State should be amended so as to provide for the payment of a small indemnity for condemned cattle, and for their shipment, under suitable restrictions, to slaughtering plants having meat inspection. An appropriation should be made for the State Veterinary Department sufficient to enable it to employ men to make the tests of dairy herds as fast as the calls for the tests are received. An appropriation should also be made for the prompt payment of the indemnity granted by the State. Under these conditions we have the assurance that the applications for these tests will be as numerous as any force of men which the State is liable to provide will be able to answer. The practice of granting indemnity and allowing the shipment of condemned tuberculous cattle, recommended, is followed in all states and countries which attempt to control tuberculosis. Such shipment is considered safe by the most eminent scientists. Granting indemnity by the State is especially intended to benefit the poor dairyman who has his whole fortune invested in a few head of cows. Now and then all the cows belonging to one of this class are found tuberculous and when they are condemned, their owner is left penniless. The uncertainty as to upon whom such ill luck will fall has heretofore made all of the poorer class of dairymen afraid of the test. The wealthy dairymen who are able to stand the loss of diseased cattle, are going ahead of their own accord, and cleaning up their herds. Unless the State comes to the assistance of the poorer class, the dairy business will tend to drift into the hands of the wealthy people.

If the State stands ready to answer all voluntary requests for the tuberculin test and will provide an equitable method of disposing of the cows that are found diseased, there is nothing to hinder the rapid progress of eradication work. Immediately any owner can feel safe in having his herd tested and rid of tuberculosis. Any city milk dealer can justly demand the test of all of the herds from which he buys his milk. Any creamery in the State can do the same thing in regard to herds from which it buys cream. Any of the smaller cities of the State can have their dairies cleared of tuberculosis by simply passing and enforcing an ordinance requiring the test. There will be practically no opposition on the part of the dairymen to delay the work. Thus, testing the dairy herds about one after another of the smaller cities of the State, we can soon cover the whole State and have those dairy herds free from tuberculosis. Taking the herds of one creamery after another we can soon have all of these herds clear of tuberculosis. Within a very short time we can test the herds selling to one or more milk dealers in each of the larger cities and thereby put milk from healthy cows in reach of all those citizens who are interested in the matter. Working along these plans we will eventually cover the whole State at the least possible expense and without stirring up the opposition which has delayed similar work in older states to the end that in some of them it has already become a hopeless task.

SLAUGHTER HOUSES.

There is still general lack of cleanliness and sanitation about the slaughter houses in this State which are not under Federal inspection. There is nothing whatever to hinder slaughtering of diseased animals for human food. The rigid inspection in the plants under Federal supervision prevents the purchase of animals that show evidence of disease for slaughter in such plants. The buyers for these plants inform themselves as to the localities where disease, especially tuberculosis, is prevalent. They try to avoid the purchase of animals that show disease or come from badly diseased areas. The natural result is that the owners of diseased food animals will sell to butchers who are not under meat inspection. The most of the butchers avoid the diseased animal, but there are enough unscrupulous butchers, who will slaughter them, to make the uninspected meats of a very uncertain quality. Thinking people, especially those who are financially able to pay good prices for meat, are rapidly drifting to the exclusive use of inspected meats. The bulk of our inspected meat comes from those firms which are generally understood to be in the packing house trust. Conditions, at the present time, are driving business into the hands of the already financially powerful packing firms. Through our own neglect we are indirectly strengthening the packing house trust.

During the coming year I hope to take the matter of meat inspection up with the mayors of the various cities of this State and try to secure an organization which will formulate intelligent and practical plans for the regulation of the slaughtering of food animals and the production and sale of milk in the cities. I cannot now give any definite outline of the probable plan, but will submit the matter to the board from time to time during the coming year.

INVESTIGATIONS.

Without much more delay, investigations ought to be made (1), to ascertain whether or not animals that are diseased, or otherwise unfit for food, are being taken from the public stock yards in this State to nearby slaughter houses, or, in case of milk cows, to be added to dairy herds; and (2), whether or not breeders in other states are culling out their tuberculous cows and shipping them into this State.

The Federal yard inspectors have no authority over animals at the public stock yards, unless such animals are for interstate shipment, or for slaughter in a packing plant engaged in interstate business. Any animal, no matter how badly diseased, may, under present conditions, be taken from a public market in this State to any other point within this State for slaughter or for addition to a dairy herd without let or hindrance. Many such animals are doubtless now being added to our dairy herds. There is considerable evidence to the effect that diseased cattle and hogs are continually being taken from the public stock yards to nearby slaughter houses to be slaughtered for use as human food. A thorough investigation of this matter ought to be made at the earliest moment, and, if it is found necessary, the State ought to supplement the Federal yard inspection to the end of completely preventing the removal of diseased animals therefrom for slaughter or for addition to dairy herds.

There are a number of well known cases of the shipment of tuberculous cows into this State for breeding and dairy purposes. This of itself is enough to justify the State in requiring certificates of health for all breeding and dairy cattle imported into the State.

If it should appear from an investigation that tuberculous cattle are being imported in considerable numbers, or that breeders in other states are unloading their tuberculous cattle on this State, a suitable law or quarantine regulation ought to be passed to prevent it. I will, as far as possible, closely observe this matter during the coming year, and will submit recommendations to the board as may be necessary.

LEGISLATION.

In my opinion, the following laws should be secured and I recommend that the Board of Agriculture urge their passage by the next General Assembly: 1, a law authorizing the Board of Agriculture, whenever necessary, to put an inspector at each of the public stock yards in this State with authority to prevent the removal therefrom of diseased animals for slaughter or addition to dairy herds; 2, a law providing for the disposition of cattle that are found diseased with tuberculosis or such as may become affected with foot and mouth disease.

APPROPRIATIONS.

For each of the last five biennial periods the appropriation for the use of the State Veterinary Department in the control and eradication of contagious diseases of live stock has been $16,200. This is only $8,100 per year for the payment of the salary and expenses of the State Veterinarian and the per diem and expenses of twenty-five deputies. The amount of money appropriated for this purpose has not been increased to meet the increased demand for control work. With the limited sum available, it has been absolutely impossible to attend to all the work. Many outbreaks of contagious diseases have, of necessity, been left without any investigation whatever. During the year 1908, there were some forty-three outbreaks of scabies among sheep which we were compelled to neglect. Numerous calls for the tests of herds of cattle for tuberculosis had to be neglected. No attempt was made to attend to the control of the various outbreaks of hog cholera. We could not employ men enough to prevent losses from Texas fever in Newton and McDonald counties and had to neglect Ripley county altogether.

As further evidence that this biennial appropriation is not in keeping with the vast live stock interests of this State, I submit herewith some comparative statistics.

State.	Number of horses and mules.	Number of cattle.	Total value of live stock.	Biennial appropriation for control of contagious diseases.
Massachusetts	75,332	285,944	$14,730,169	$154,000
Pennsylvania	629,040	1,896,847	97,424,119	185,000
Minnesota	704,808	1,871,370	86,620,643	108,000
New York	631,761	2,596,389	120,673,101	150,000
Missouri	1,250,556	2,978,589	154,295,363	16,200

It is false economy to withhold the expenditure of money in the eradication of a contagious disease when the loss from the disease is a hundred-fold what it would cost to prevent it. With methods now available of immunizing hogs against cholera the prevention and eradication of any and all contagious diseases of live stock is an absolute certainty. Once completely eradicated, the loss of stock from contagious diseases and the cost of their half-hearted control will be stopped.

Heretofore, through lack of funds, we have had to confine our efforts toward the control of contagious diseases to work on glanders, sheep and cattle scabies, Texas fever and a few diseases that it has been the custom for years to try to control. The Texas fever work alone, incomplete as it was, took $3,600 of the $8,100 allowed for the past year. It will require all of the $8,100 to properly control Texas fever and prevent losses from it. The appropriation for the lines of work that we have heretofore undertaken should be increased from $16,200 to $20,000.

In addition, an appropriation of $20,000, making $40,000 in all, ought to be secured for immunizing hogs against cholera and answering calls to inspect dairy herds for tuberculosis. The financial gain from the former will amount to enough in a single month to repay the entire State appropriation. The eradication of tuberculosis from our older dairy herds, and starting the thousands of beginners in the dairy business with sound herds, is a matter of too vast importance to admit of any estimate in dollars. It is enough to say that unless the spread of tuberculosis among dairy cattle is promptly stopped it will ruin one of the greatest industries of this or any other state. With tuberculosis prevalent among the cows in our dairies we can never hope to stop the loss of human lives from this disease. I therefore recommend that the State Board of Agriculture ask for an appropriation of $40,000 for the control and eradication of contagious diseases of live stock.

Respectfully submitted,

D. F. LUCKEY.

Farmers' Week in Agricultural College.

January 5, 6, 7, 8, 1909.

Sixth Annual Meeting Missouri Corn Growers' Association, Twelfth Annual Meeting Missouri Improved Live Stock Breeders' Association, Nineteenth Annual Meeting State Dairy Association, Third Annual Meeting Missouri State Sheep Breeders' Association, Second Annual Meeting Missouri Swine Growers' and Breeders' Association, Second Annual Meeting Missouri Housekeepers' Conference, and First Annual Meeting County Highway Engineers' Association.

(*Conducted under the auspices of the State Board of Agriculture.*)

AN ABSTRACT OF THE ADDRESSES DELIVERED.

This was truly a great convention. The estimated attendance was 1,200 farmers and farmers' wives, representing all sections of the State. This was the most complete programme carried out during the history of Farmers' Week, and the good influence of the work done here will be noticeable throughout the State.

It is impossible to print a full report of the proceedings, including a discussion of the demonstrations that were made during the week; but we have selected the papers and discussions which are thought to be most useful to the farmers of the State.

Improved Live Stock Breeders' Session.

Tuesday, January 5, 1909.

ADDRESS OF WELCOME.

(Dr. A. Ross Hill, President of University of Missouri.)

Ladies and Gentlemen, and Members of the Convention:

It is a pleasure to me, as President of the University, to welcome you here this morning as you gather to discuss matters that affect interests that are more or less personal to you, and which are also of vital interest to the development of the wealth and intelligence of the State. The agricultural interests of the State are our greatest economic interests, and you who gather here at this time to take part in these discussions, have at stake in your discussions the most important issues that affect the State, and also the nation, because our agricultural resources are the greatest resources in America.

Your chairman has said that I am a farmer's son. I was also a farmer myself for a good many years—during the formative period of my life when I got my first tastes and habits developed I lived on a farm. I could not attempt to speak this morning about farming in detail, because I find that as I recall the days that I lived on the farm, and compare the conditions then with the agricultural activities of today, I am already a prehistoric creature in the matter of farming. The farming community, as I knew it, was a community in which not only the farming activities that you know were carried on, but all the processes of manufacture from the raw materials were carried on right there on the farm. For instance, I used to help to take wool from the sheep's back and wash it and spin it, and afterwards wear it on my own back; so you will realize that I am plainly an ancient creature in the matter of farm life, because today, so far as I am able to gather information, the farmers are *specialists*. They are concerned with only a certain phase of the activities that were formerly carried on, and they get in return for the products of the soil the manufactured articles that are made for them sometimes in remote parts.

As I can not speak to you this morning in regard to any topic that directly affects the work of tilling the soil, or the rearing of stock, in any way that would be interesting or enlightening, I am going to say a word about the rural school, a subject which I know is of interest to you, because you are also educators. We are all educators—all interested in the development of youth. Our economical activities, and the economic results of our labors will, after all, turn in the main in the direction of rearing and educating children, and as I had my first experience as a teacher in a rural school, I want to take a moment to call your attention to some problems that we are facing in that phase of our rural activities and rural life.

The rural school, at one time, was counted the typical and natural school, and I claim that it is still. Education began in the home or perhaps at times it was even less formal than that, but was brought about through the plays of the children—carried on at moments when not busy with something else; but with the earliest dawn of civilization the *family* had to begin the education of the children, and they got in the home the best and most fundamental training.

The next step, where the community grew large enough for the people to wish to unite, and when civilization advanced enough so that the family could not carry on all the education of the children, then a few families united to employ a teacher and bring him into the community. He boarded around from house to house and was, as it were, a representative of the families that had united. My older brothers went to a school of that sort, and I can remember hearing my father tell of how they had employed a teacher and paid him $8 a pupil, and that he came into the community when a certain number of pupils were guaranteed him, and he lived from house to house.

The next kind of school was the rural school to which everyone in reach of the school could send a pupil whether they could pay anything or not. Our city schools, with their graded system, with two or three different stages in the first grade and two or three for each of the grades, making in all 16 or 17 grades—all that is a product of recent times, and I want to say I think the city school as usually organized, is abnormal. As the family is the natural educational institution, so the rural school, where boys come together from the ages of 6 to 14, and have the privilege of the experience of those older and younger than themselves, is the natural type of school for the person to attend during his growing years; and it seems to me that this is one of the problems that is of interest not only to farmers, not only to those who live in the rural communities, but to those who are interested in American civilization—this question of rural schools and what is to be done about them.

When I go to teachers' associations, I hear the discussions turn on grading that school and keeping the records in that school, and make it like the city schools, and I say to myself (although I dare not say it aloud) they are forgetting that the rural school is one that should be adapted to rural life and ought to be made better adapted to rural life instead of trying to make it like the city school. One of the best things I can remember in the old rural school was the association with pupils older and younger than myself, and another great thing was the very fact that I was thrown on my own responsibility, and was forced to work independently. There was often only one or two persons in a class, and then the teacher came into direct, sympathetic touch with the pupil. The whole school was in a sense a class, and the pupils got individual help, and I claim that the rural school, although more or less ungraded and without system, even chaotic perhaps, is the most valuable place for the real, vital education of boyhood; and it seems to me that we ought to turn our attention first to improving the vitality of our rural school without changing the whole organization.

Another trouble with the rural school is that it has failed to change and advance as the life on the farm has advanced. The work in arithmetic, for instance, that I had in the rural school, was based upon commercial methods and business activities that were carried on in England about the time the American colonies were planted, and arithmetic books of today are still to some extent based upon such out of date methods and conditions entirely different from what they are today.

It has not occurred, apparently, to the teachers, that the best way to make the schools successful in the country districts is for the teacher herself to understand country life and be in sympathy with it, and utilize the opportunities in the school hours to make the pupils better able to interpret life around them. That is what education is for. It is for the development and growth of minds, but, as I understand it, it is also to provide an appreciation of the life that is lived around us today; and so the rural school, in order to be a helpful institution, must be a school that inspires, gives insight into and leads to an appreciation of rural life and rural activities. The idea that I have advanced, then, is that our teachers are better prepared in the problems given in the text books than they are in the knowledge of rural life itself, and this is getting to be more and more the case because we are drawing today into the rural school teachers who have attended a town school or a city school, whereas, in realty, we should have, and I hope that in the near future we shall have, teachers in the rural schools who have grown up in rural communities, men and women who have ceased to live for a time in the rural community while in training for their profession, but have entered into it again.

The whole problem, then, is that of vitalizing and making more significant that type of school. This can be done in several ways: One way is to teach agriculture in that school, but there is one trouble with that—offering a course in agriculture two or three times a week, or daily, for the last year of a country school, will not make very much change in the pupils' problems and outlook; it simply adds another subject to the already over-burdened course of study, and adds another subject to the overworked teacher's duties. What is more important, is that the whole education of the school should be directed towards the community in which the school is located. Take, for instance, the subject known as geography, which is defined as a study of the earth as the home of man; instead of beginning with some remote parts and studying about the various countries and then coming down to the American continent and dividing this up and studying it, and perhaps in the course of two or three years reaching the home county, why not have a study made first of the streams, of the drainage of the soil, of the forests, and of the animals and plants that grow in that community in which the school is located? I heard much, when I studied geography, about the various animals that inhabited the Andes and the Valley of the Amazon, but never one word about the cattle and horses and hogs and sheep and mice that are to be found right around home, and therefore I failed to get any concrete or natural basis from which to understand the rest of the world. In our attempt to give pupils a knowledge of the world as a whole, we lose sight of the fact that the way to get a correct knowledge of the world is to understand our own part of it first. We are still making that mistake. Those of you who are responsible can help by letting the teacher know that you want that work done; that is not teaching agriculture in one sense, but it is bringing the children into a closer sympathy with the life around them and enabling them to understand it better.

Another thing: Take the teaching of arithmetic. It is a simple matter of fact that most people know enough about numbers to be able to use arithmetical calculations if they would, but very often they fail to do so, they fail to apply what they know to the work that they are engaged in. Now, that comes naturally from the fact that during their school years they did not learn how to make use of what was taught them. How often in the rural school will the pupil and teacher be found at work on problems that would help farmers to understand whether a certain line of farming is profitable? Now, I have known a farmer who did not know whether certain lines of farming were profitable or not. You know, because you have studied the matter. But I expect that some of you know farmers who are carrying on lines of farming without ever having made an estimate as to whether the cost of production is greater or less than the returns. That may come from the fact that while children at school, they never learned to make use of the principles they were taught in arithmetic, whereas it is the most natural thing in the world. That is what the school is intended for: To enable the pupil to make use of these simple numbers in daily tasks. If the community is one in which there is lumber and the manufacture of lumber is of fundamental importance, then the arithmetical work should be directed toward that, and this will not tend in the least to detract from its thoroughness, but will give it greater significance.

But the pupil in the rural school must also be taught what is going on outside of his neighborhood. We don't want to have school work confined to the activities in the country district, or in the city, or in any particular community. The school must not confine its operations to the conditions that affect its own community. The pupil in the school needs to know something about the farming activities and farming possibilities of other communities; he needs to know something about where the articles he uses are manufactured and made into the finished product, and he needs to know and understand about transportation from one section to another. But nevertheless, this simply serves to show how important it is that the school life should be centered in the community. I had an experience in teaching history in an ungraded school. There were two boys in one class—twin brothers working together—and they were supposed to study colonial history. It is usual for a teacher to begin teaching a subject by directing the pupils to get books.

In this case I was prevented from doing this, as I did not believe that the children would get the book nor that the father would buy it. So I had to devise some other way of teaching. We were in a community which had been settled among the early settlements of America by the French, and it was a place where the tide waters of the Bay of Funday rose high at certain times, and then for about two weeks they would not rise so high, so that the tide brought up with it a deposit which settled there, and this was left bare during low tides; then the tide would come up again and overflow everything, and then recede again. When the French settled there, they had placed dykes around these tracts and made thousands of acres of land the richest on earth by thus keeping off the tides. I was teaching in a community with much land of that sort. The father of my pupils had to deal with this kind of land. I saw that the best way to teach these boys would be to make them understand that they were studying the history of their own community. So I just gathered the boys about my desk and began to talk about their own farms, and found that they knew much about them—they knew more than a teacher would who might have attempted to teach them agriculture. I began by raising questions as to what their soil was best adapted for, and why and how drained, and finally about this matter of the dykes and who erected them. One boy said his grandfather had owned the land—that he had come from another point and bought it. Finally one boy said: "I think the French diked it." I inquired who the French were, and he had a vague notion who they were. Thus our work in history was started and these boys made rapid strides in learning colonial history. I tell this to illustrate how the life right at home may open the way and lead the pupil to take an interest in human life in general, and lead him to an appreciation of the larger life of the world outside. I don't believe we need to abolish the simple rural school—we should *improve* it.

But there is another phase of school work that I want to touch upon: We used to think that when a pupil had passed through the seventh or eighth grade of the district school that he had an education. We have ceased to think that now. The world today demands a more extensive education than that, and I am sure that those of you whose children are going to stay on the farm want them to know more about the world and how to improve methods of farming in which they are engaged. That will call for the development of the high school, and the high school in the rural community can also be easily gotten. We already have a law providing for the consolidation of a few districts in order to form a central school, and we want to look forward to the development of country high schools that will bring high school instruction, especially in agriculture for the boys and in domestic science for the girls, right near the homes of the boys and girls. We can never get that until it is possible for the State to give aid to the individual community, because it is only in a few communities where this provision of our present school law is worth anything. In Jackson county, I believe there are three or four of these schools, and I take it that it is possible to have them now in the best farming districts of the State, but in a great many districts it will not be possible until the State comes to aid us in the establishment of these rural high schools, and I hope that that will be a step taken in the near future—the development of high schools adapted to training the youths for life on the farm and also to train them for teaching in small rural schools, and in some case enabling them to go on to the Agricultural College of the State University. We in the University are, of course, specially interested, in rural schools and the development of country high schools, because, as anyone knows who observes university life, our very best students in the University are to be found among those who come from the rural communities and who by hard work and indirect methods have reached the university course. In my college days, I observed that of the men who stood out as prominent students, three-fourths of them were from the farms, and I am afraid that with the lack of high school facilities in the rural communities, this situation is likely to change because our towns are developing high schools rapidly, and the boy on the farm is now at greater disadvantage compared to his town brother than formerly.

We are interested in this matter for other reasons: One of our departments here concerns itself directly with the life on the farm, and we are at present cut off, except for our short course, from direct touch with the rural communities so far as the coming of students from those communities is concerned, and this agricultural college is therefore vitally interested in seeing the connecting link established in the way of these country high schools so that we can have a direct connection with the rural pupils who wish to take an agricultural course here as well as the indirect one through the town high schools. It seems to me that if the Agricultural College is to do the greatest service to the agricultural communities of the State, it will have to find an opportunity to teach not only the adults of the farming population by sending them bulletins from the experiment station, but it must find an opportunity also to teach the enthusiastic growing youth, and that I think will best come through the development of rural high schools taught by graduates of the Agricultural College. The rural high-school may come either by the consolidation of rural district schools or without that.

How are we to get competent teachers? I know you are interested in getting such teachers if it is possible to do so. We have here every winter courses running for three months known as the short courses for young men living on the farms. It seems to me that we might devise some similar plan for training teachers for the rural schools. We might devise some plan of giving an opportunity, during this period of three months, to young men who have graduated from district schools and who think of teaching in district schools. If I were employing a teacher for a rural school, I would prefer a young man of 17 or 18 years of age who had passed through one of those country schools and then had come here for the winter course in general agriculture, with perhaps a summer here afterwards to take up other subjects, than one who had gone away from that rural school to a high school and had come back to the rural community with the conditions and methods of the town school in mind. There needs to be some way provided by which we can get the boys who grew up in the country district back into that district to teach.

Again let me say, I welcome you here this morning, not only because you are here to discuss these questions bearing upon your own farm work, and upon our instruction in agriculture, but because I have this opportunity to speak to you about that which interests all of us—the development and improvement of our country schools, and thereby the enrichment of our country life and the development of our country youth. I trust the days you spend here will be found to your profit and interest. Anything that the university can do for you will be gladly done, and I hope you will take away from the convention new inspiration, and that you will bring to us an inspiration for the improvement of our work, because really in the university as well as in all other educational institutions, we need to keep in close touch with the conditions of the actual life around us. I am sure that these meetings will give our men in the Agricultural College encouragement to take fuller advantage of the opportunities they have to adapt themselves and their work to the needs and conditions of the farming life of the State.

THE TIME TO HARVEST TIMOTHY FOR THE LARGEST YIELD OF THE MOST NUTRITIOUS AND PALATABLE HAY.

(By H. J. Waters, Dean College of Agriculture.)

The experiments and careful observations conducted at the Missouri Station on which the following conclusions are based have extended over a period of twelve years. In this brief summary of the practical teachings of these investigations, it is impossible to present much of the tabular data. The reader who is interested in a more detailed and careful study of the subject is referred to a bulletin on this subject soon to be published by the Missouri Experiment Station, which will report in full the results of these experiments.

Hay is the second most important crop on the Missouri farm, standing next to corn in value, and far ahead of wheat, oats, fruit, etc. For example, what might be termed at this time a fair average acreage and production of the principal crops of Missouri would be as follows:

Corn, 7,000,000 acres; 200,000,000 bushels; worth $75,000,000 to $100,000,000.

Hay, 3,000,000 acres; 4,000,000 tons; worth from $25,000,000 to $35,000,000.

Wheat, 2,000,000 acres; 30,000,000 bushels; worth from $25,000,000 to $30,000,000.

Hay is a bulky product, relatively expensive to put into condition for transportation, and in proportion to its value, very expensive to ship. On this account a large proportion of all the hay produced in Missouri is fed to live stock on the farm where it is grown; a larger proportion than of corn or oats, and necessarily a much larger proportion than of wheat, which is primarily a sale crop.

Viewing the matter from the standpoint of the producer of hay, the following important factors are to be considered:

1. Yield.
2. Palatability.
3. Feeding value.
4. Convenience in harvesting.
5. Keeping qualities.
6. Permanency of the stand.

7. Selling quality. (Only for that portion which is offered for sale.)

The influence of the time of harvest, or the stage of the development of the plant when harvested, upon all these factors has been studied. Selected areas of pure timothy of uniform development were harvested at five different stages of growth, and the cured hays were carefully weighed and analyzed. Digestion experiments with cattle were made, and in some instances actual feeding tests were conducted to determine whether the early-cut hays were more palatable to the animals than the later cuttings.

The five stages of development which we sought to approximate in harvesting were as follows:

First cutting: When plants were just in full head, on the average about June 12th.

Second cutting: When the plants were on the average in full bloom, about June 18th.

Third cutting: When the seed were formed, or when the bloom had all been shed, usually about July 1st.

Fourth cutting: When the seed were in the dough, about July 8th.

Fifth cutting: When the seed were ripe but had not shattered, about July 16th.

1. YIELD OF CURED HAY PER ACRE.

The yield of cured hay at the time of harvest is a very unreliable guide. The hay is put up at one cutting with more water than at another, and will therefore weigh heavier. As would be expected, there is therefore no consistency, one year with another, in the yields of cured hay, cut at different stages of maturity. This is one reason why the farmer's experience has not enabled him to tell more accurately which cutting has given him the largest return. The reader's attention is especially invited to the yield of dry matter and of digestible material obtained from the various cuttings as given a little further along in the paper. In the meantime he may be curious to know which cutting gave the largest return of cured hay at the time of harvest. This information follows:

The first year the second cutting, or when the plants were in full bloom, showed the largest yield of cured hay, and the third cutting, when the seed were just formed, the next largest. There was no difference between the fourth and fifth cuttings, but they showed 600 pounds less hay per acre than the second cutting. The lightest yield of cured hay was from the first cutting, which was 1,240 pounds per acre behind the second cutting.

The next year the last cutting, or when the plants were fully ripe, gave the largest yield of cured hay, while the first cutting, or when the plants were just in full head, was a close second, being only 240 pounds per acre behind the last cutting. There was practically no difference between the yields of the second, third and fourth cuttings, they being about 400 pounds per acre behind the other two.

In the third year of the experiment, only two cuttings were obtained, viz., the third and fourth. This time the fourth cutting gave the larger yield of cured hay.

In the fourth year we had all five cuttings. The fourth cutting, viz., when the seed were in the dough, showed the largest return of field cured hay, and the third cutting, with the seed just formed, a close second. The first cutting, when the plants were in full head, stood third, and the second cutting, when in full bloom, fourth, and the smallest return of field cured hay came from the fifth cutting, when the plants were ripe.

In the fifth trial the first cutting was lost on account of rain. The third cutting showed the maximum yield of cured hay, with the second coming second, but 480 pounds behind; the fourth cutting ranked next, being 580 pounds behind the third, and the fifth cutting, when the plants were ripe, gave the smallest yield of cured hay, being 840 pounds per acre less than was obtained from the third cutting, when the seed were just formed.

As stated at the outset, these returns show no consistency, on account of the difference in amount of water that the hay contained at the time it was weighed and put up.

2. YIELD OF DRY MATTER PER ACRE.

The value of hay as food is determined by the dry matter it contains and by its digestibility. We are therefore interested to know at what stage of the development of the plant we may expect to secure the largest yield of dry material.

In the first year of the experiment the largest yield of dry matter was obtained from the third cutting, when the seed were formed. The fourth cutting, with seed in the dough, came as a close second, being only 130 pounds per acre behind the third; the second cutting, when the plants were in full bloom, stood third, with a yield of 200 pounds less than the third. The fifth or last cutting, when the plants were fully ripe, stood next in order of yield, being 280 pounds per acre behind the third cutting, and the smallest yield was from the first cutting, when the plants were just headed, the difference in the yield between this and the third cutting being 870 pounds per acre.

In the second year of the experiment the largest yield of dry matter per acre came from the second cutting, when the plants were in full bloom. Following this was the fifth cutting, when the plants were mature, the difference between the two cuttings being only about 80 pounds per acre. Closely following was the third cutting, when the seed were just formed, with a difference of 106 pounds per acre, and following this, the fourth cutting, with a difference of 120 pounds per acre, while the smallest yield was again the first cutting, with a return of 360 pounds less than the second cutting.

As stated before, only two cuttings, viz., the third and fourth, were obtained in the third year of the experiment. In this case, the fourth cutting, when the seed were in the dough, showed the largest yield of dry matter, the third cutting being practically 100 pounds or some 4 per cent less.

In the fourth year of the experiment the third cutting, or when the seed were just formed, gave the highest yield of dry matter, with the fourth cutting, when seed were in the dough, a very close second, the difference being so small as to be easily within the limit of error, and the second cutting, when the plants were in full bloom, taking third place, with a yield of 175 pounds or some 4 per cent less. The fourth place fell to the fifth cutting, when the plants were ripe, the yield in this case being some 675 pounds or 15 per cent less than the maximum yield for that year. The first cutting again gave the smallest yield of dry matter, showing a difference of nearly 925 pounds, or 21 per cent less than the third cutting.

The fifth year of the experiment gave essentially the same results as the previous years. The third cutting again showed the highest yield of dry matter. The second cutting followed, with a difference of 265 pounds, or 11 per cent. This was followed by the fourth cutting, which showed a decline of 400 pounds per acre, or 17 per cent, and the smallest yield came from the fifth cutting, the decline from the third cutting being 555 pounds of dry matter per acre, or 23 per cent.

Taking the average of the three years in which all five cuttings were made, we find that the third cutting gave the largest yield of dry matter, as well as the largest yield of field cured hay. The fourth cutting, when the seed were in the dough, stood second, the difference being only 1¾ per cent, or 50 pounds less of dry matter per acre. The second cutting was third, with a decline of 3 per cent from the third cutting, or a difference of 125 pounds of dry matter per acre. The fifth cutting, when the plants were ripe, ranked fourth in yield of dry matter, being nearly 350 pounds, or 8½ per cent behind the third cutting. The first cutting, with the plants in full head, showed the smallest yield of dry matter, being 16½ per cent, or 680 pounds behind the third cutting.

INFLUENCE OF MATURITY OF THE PLANT UPON ITS DIGESTIBILITY.

After all, the stockman is interested in the amount of digestible material his feed contains rather than the yield of cured hay or dry matter.

Digestion experiments were made with yearling and two-year-old steers, and it was found in every instance that the first cutting was the most completely digested, and that there was a steady decline in digestibility from that time on.

3. YIELD OF DIGESTIBLE MATERIAL PER ACRE FROM THE VARIOUS CUTTINGS.

Considering the yields on the basis of the amount of each that the animal is able to digest, as determined by our trials, the first year showed the maximum digestible material at the second cutting, when the plants were in full bloom, with the yield for the third cutting practically the same. There was then a decline of 8.5 per cent to the fourth cutting, when the seed were in the dough. The first cutting ranked fourth in yield, being 10 per cent behind the maximum or second cutting, whereas the fifth cutting, when the plants were mature, showed 15 per cent less yield than the second cutting.

In the second year of the trial the hay when harvested in bloom or at the second cutting, again showed the highest yield of digestible matter. Unlike the previous trial, however, the first cutting, with the plants in full head, was a close second, being only 1.5 per cent behind the second cutting. There was then a heavy decline to the third cutting, with the seed just formed, the difference being 250 pounds of digestible material per acre, or 10.5 per cent, followed by the fifth cutting, with a decline of 14.5 per cent from the maximum yield, and this closely followed by the fourth cutting, with the seed in dough, with a loss of 15.25 per cent.

In the third year of the trial the second cutting again showed the highest yield of digestible material. The third cutting, with the seed formed, stood second, with a decline of 4.25 per cent, with the fourth cutting next, showing a decline of 9 per cent; the first cutting stood next in rank, with a loss of 12 per cent over the second cutting, and the smallest yield of digestible material was from the last cutting, the difference being 23.5 per cent or a loss of 520 pounds of digestible material per acre.

In the fifth year of the experiment, as before stated, the first cutting was lost. This year, for the first time, the third cutting, when the seed were formed, gave the maximum yield of digestible dry matter; the second cutting stood next, with a difference of 3 per cent; following this there was a heavy decline to the fourth cutting, the loss being 21 per cent, and a still further decline to the fifth cutting, the loss from the third being 27.3 per cent.

Averaging all of the trials, it was found that in digestible dry matter the rank was as follows:

Second cutting, maximum yield.

Third cutting next, with an average loss of 120 pounds, or 3.5 per cent.

First cutting, third, with an average loss of 165 pounds, or 7.5 per cent.

Fourth cutting, fourth, with an average loss of 245 pounds, or 21.25 per cent.

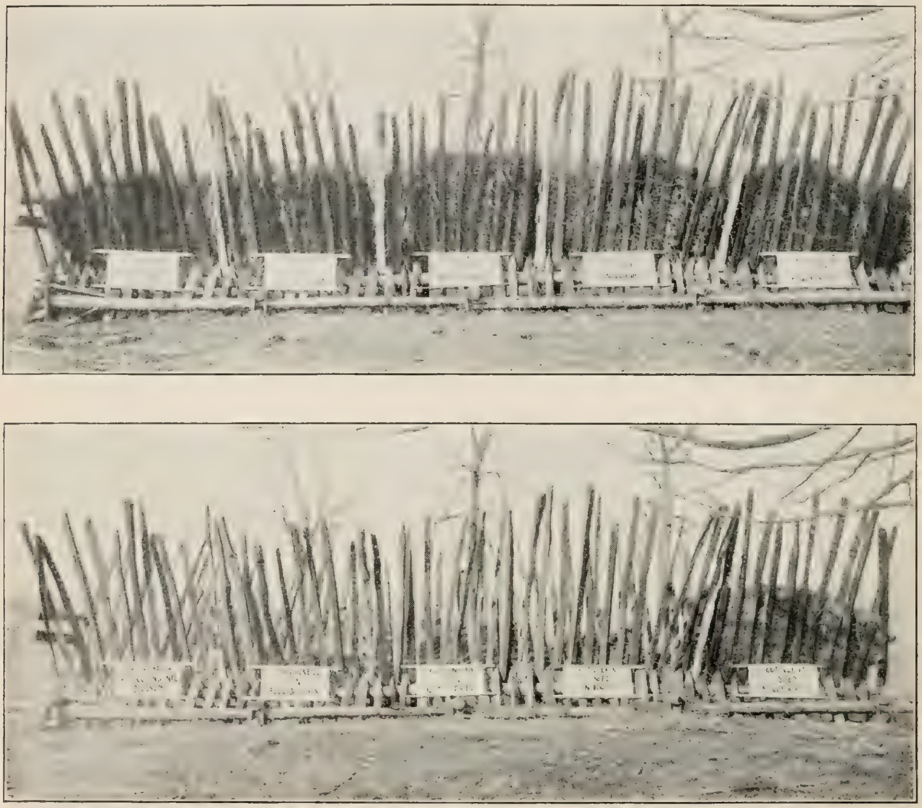
Fifth cutting, last, with a loss of 475 pounds, or 27.75 per cent.

In short, if no other factors were involved in the problem than the yield of digestible dry matter, the farmer, in order to secure the largest yield, would be forced to harvest his hay when in full bloom, which, in Central Missouri, would be about June 20th.

If he had harvested it eight or ten days earlier than this, or when the plants were just in full head, he would have sustained a loss of 7.5 per cent of his yield. By harvesting eight or ten days later, or when seed were formed, the loss would have been 3.5 per cent. By waiting another week or ten days, he would have harvested only about five-sixths as much digestible material as when the plants were in full bloom, and by waiting until the plants were fully ripe, he would have harvested a little more than four-fifths as much digestible matter.

4. PALATABILITY OF HAYS CUT AT DIFFERENT STAGES OF MATURITY.

The notion is somewhat prevalent that the late cut hays are more palatable than those cut earlier, and that if cattle, horses or sheep were given the opportunity to choose among these cuttings they would manifest a decided preference for the maturer hay.



SHOWING HOW CATTLE PREFER TIMOTHY THAT IS CUT EARLY.

The top picture shows the racks filled, 100 lbs. in each. Beginning at the left with the green cut hay. The lower row shows how it was eaten out of the racks.

To settle this question, we put an equal amount, viz., 100 pounds, of each cutting in a long rack, and gave two yearling steers that were being fed exclusively on timothy hay free access to the rack. Only two animals were used, because we wanted to avoid any possibility of crowding and of the stronger animals forcing the weaker ones to eat hay that they might otherwise have discriminated against. This experiment was continued through two years, all of the cuttings having been harvested and cured without rain, and stored in a barn until required for this trial.

In every case the animals ate the hay in the order of their cutting. They did not always clean up the first cutting before they would eat considerable out of the second and some out of the third, but in every instance, and the experiment was duplicated several times, they practically cleaned up the three first cuttings before they began on the last two. In other words, while these animals showed a preference for the first cutting over the second and third, the discrimination against the fourth and fifth cuttings was very marked indeed. As between the last two cuttings, there was a sharp discrimination in favor of the seed in the dough, or the last hay to be cut was the last to be eaten. Thus hay that was allowed to stand until the seed were in the dough had lost much of palatability, and if allowed to stand until the plants were mature, had declined still further.

The accompanying illustrations show very strikingly the preferences of the animals.

It is to be borne in mind that the experiments referred to above were made with animals having nothing but timothy hay, receiving no grain or other feed. When animals that were fed more liberally were given the opportunity to choose between these hays, they did not show so decided a preference for the earlier cuttings as did the animals that were making their whole ration of hay.

For example, two registered Jersey cows in full flow of milk that were being fed rather liberally on grain and having all the silage they would eat at the barn, when turned to the rack filled with these various cuttings, in the middle of the day when out for fresh air, ate one of the first three cuttings with apparently as much relish as the other. They did, however, discriminate sharply against the last two cuttings in every instance.

In the case of some fat wethers that were on full grain feed, when turned to these five hays, ate one with as much apparent relish as the other.

The accompanying photograph of the sheep rack filled with these hays shows that they did not seem to discriminate against the late cuttings as did the animals that were not so heavily fed.

Unfortunately the trial was not made with horses and mules.

5. CONVENIENCE OF HARVESTING.

So far all of the results have been in favor of the earlier cuttings. The yields were larger, the hay was more completely digested, and was more palatable to the stock. In matter of convenience of harvesting, the balance tips heavily the other way. The greener the grass is cut, the longer the time required to cure it, the more easily it is damaged by showers and heavy dews, and the more readily it will sunburn. Moreover, the weather at that time is not nearly so settled, the ground is not so dry, and none of the conditions are so favorable for hay making as later. Of more importance than all of these, in the corn belt, the farmer is not ready by June 20th to harvest his timothy. He has just finished his wheat or clover, or both, and is then somewhat behind with his corn. It is imperative that his corn be cultivated just at this time. On the average farm, therefore, a larger loss would be sustained by keeping out of the corn at this time than by allowing the timothy to stand until a little later to be harvested. It is simply a question of choice between evils. Loss on one or the other crop must be sustained, and the lesser loss is in allowing the timothy to stand until later to be harvested than to allow the corn to go uncultivated.

6. KEEPING QUALITIES.

It goes without saying that the later cut hay will stand more exposure to the weather and will turn rain better in the stack than will the earlier cut hays.

7. PERMANENCY OF THE STAND.

This is almost as much of a mooted question as the original one as to which gave the largest yield. The consensus of opinion in the corn belt, however, is that by cutting earlier, the life of the meadow is materially shortened. This has led many farmers to adopt the practice of allowing the plants to become fully mature so that enough seed would be shattered in harvesting to keep up the stand.

MENDEL'S LAWS AND THEIR APPLICATION IN THE BREEDING OF PLANTS AND ANIMALS.

(By W. J. Spillman, U. S. Department of Agriculture.)

A dozen years ago the subject of heredity was usually not taught in our colleges; we did not know enough to justify teaching it. Even yet the subject is rather poorly organized from a pedagogic standpoint, but there is plenty of subject matter for a strong college course. This matter is rapidly assuming form, and is even now, in some of our leading colleges, one of the most important and most popular biological courses.

The discoveries in this domain during the past decade are nothing less than epoch making. We do not even yet appreciate their full importance, yet important applications of this new knowledge have already been made in the improvement of crops and domesticated animals.

During the last two years of the past century, five men, working independently of each other, discovered three highly important principles, or laws, which enable us to predict the results of the crossing of two distinct varieties for the second and later generations of the progeny. The discovery of these laws was hailed with much enthusiasm, as it was the first inkling we had had that there are any laws governing the transmission of hereditary character from one generation to the next.

After the discovery was announced, Correns, one of the men who had made the discovery, in searching through the literature of the subject to see whether the law had been recognized previously, called attention to the fact, then not generally known, that these laws had been worked out in very great completeness, by a monk in an Austrian monastery, and published in 1865, and they have very appropriately been named "Mendel's Laws," for this was the name of the recluse who, working with varieties of the common garden pea, had made discoveries which enable us now, I am tempted to say, to produce almost any type of plant or animal we desire, provided we can find the characters we want scattered amongst races or varieties that can be crossed with each other. There are, however, many limitations in the application of these laws, but new facts are being discovered concerning them almost daily. We do not know that all hereditary characters obey Mendel's laws, but many hundreds of them do, and it is barely possible that all do. The highly significant fact is that we have discovered laws which hundreds of hereditary characters do obey. It is now my task to give an exposition of these laws, together with some of the important results which have followed their application in the breeding of plants and animals.

Suppose we cross a bearded wheat with a smooth (beardless) wheat. (Fig. 1.) Experience shows that this gives a wheat which is smooth, or only very slightly bearded. In this cross we bring together two naturally antagonistic characters. For some reason one member of this pair of characters prevents the other from developing. The biologist expresses this fact by saying that smoothness is dominant over beards, or that beards are recessive to smoothness. Generally speaking, one member of a pair of antagonistic characters is more or less completely dominant over the other. For instance, if we cross a polled breed of cattle with a horned breed none of the progeny will have perfect horns. About 5 per cent of them will have what cattlemen call "scurs," that is, imperfect horns. The other 95 per cent will be as perfectly polled as their polled parent. Thus, the poll character is said to be dominant and horns recessive, though the dominance is not absolute in all cases.

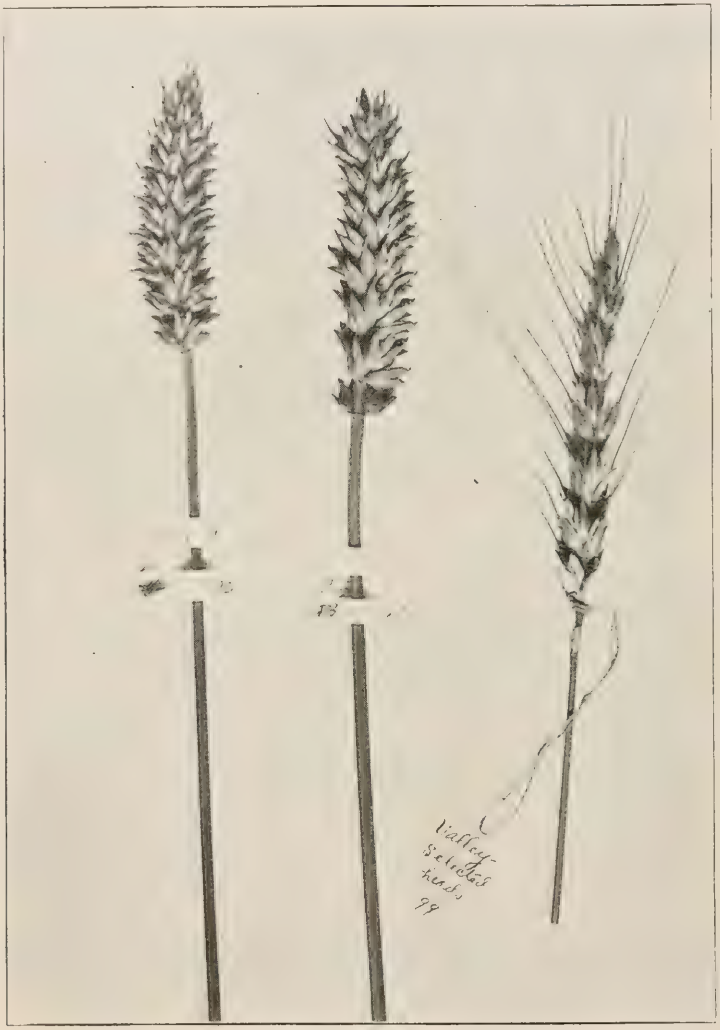


Figure 1.—Bearded wheat crossed with beardless.

The cases cited are illustrations of what we call "Mendel's law of dominance." We have many beautiful illustrations of this law. For instance, if red tomatoes be crossed with yellow the fruit of the hybrid is red. If white hogs be crossed with black or red the hybrids are nearly always white. If the white faced Hereford cattle be crossed with cattle having a colored face the crossbred animals have white faces. If a red rose be crossed with a white rose the hybrid is red. If a pink-eyed albino be crossed with an individual having no albino blood, none of the progeny will be albino.

DOMINANCE NOT ALWAYS PERFECT.

The dominance of one character over its opposite is seldom absolute. In many cases there is some indication of the hybrid character of the progeny. Even if there is no other indication the hybrid is usually stronger growing and more vigorous than the pure bred. But frequently the recessive character itself shows, at least partially, in some individuals resulting from the cross. As stated above, the cross between bearded and smooth wheat shows a slight tendency to be bearded. The cross between polled and horned cattle in a few individuals develops imperfect horns, or scurs. Recessive characters are especially likely to show when age comes on.

In some cases, however, we have a very different result. There is a certain red primrose which, when crossed with a certain white primrose, instead of giving red progeny gives a beautiful purple flower. This primrose has for years been sold on the market under the name of "Imperial Primrose;" but it is a hybrid and does not reproduce true to seed. We shall later see why this is the case.

In some crosses, instead of having dominance of one character over its opposite, the hyprid is intermediate between the two parents. For instance, in my work with hybrid wheats some years ago, I crossed several varieties of the ordinary types of wheat with the extremely short headed club wheats grown on the Pacific Coast. While the hybrids produced club shaped heads with the characteristic dense growth of the club varieties, these heads were nearly always longer than the original club heads, so there could not be said to be complete dominance of the club character. Prof. Castle, of Harvard, crossed long-eared rabbits with ordinary rabbits, and the progeny had ears intermediate in length between those of the two parents. On the other hand, when dwarf peas are crossed with standard sorts the hybrid grows even taller than the standard parent.

These illustrations are sufficient to make clear the law of dominance and the fact that this law is not universal. We come now to a more important law, the law of separation of character pairs. It is this law that is ordinarily meant when we speak of Mendel's law, because it is so much more important than the law of dominance.

It is part of the irony of fate that Mendel's discoveries were utterly ignored and even forgotten during his life time. He never knew he had made an epoch making discovery. When the whole world went to breeding improved varieties of plants these discoveries were made again. Now we are building a monument to Gregor Mendel at Brünn, Austria, in the little monastery garden in which his epoch making work was done.

MENDEL'S LAW OF SEGREGATION.

We have seen what happens when a pair of antagonistic characters are brought together; that is, what happens during the life of the individual bearing these two characters. But what happens to this character pair in passing to the next generation? The bodies of all plants and animals are composed of small parts called cells; each of these cells is, in a sense, an elementary plant or animal. Our bodies are in reality colonies of very minute organisms, each of which has its particular work to do. Some of these cells manufacture the digestive juices, some form the bone, others become muscular tissues; some of them become red blood corpuscles, etc. While growth is still in progress it is these cells that do all the growing. When one of them reaches full size, it splits into two, and each of the new cells thus formed in turn grows to full size. The internal structure of the cells is very complex. Indeed, it is a wonderful structure, but I can not here stop to describe what we know about it. It would take more time to do that than is available for this whole lecture. Prof. E. B. Wilson has written a 500-page book about these cells, and what has been learned since that book was written would make another book as large. Suffice it to say that when one of these cells reaches maturity, and splits into two new cells, each of the important organs in the cell divides also, so that, speaking in a general way, each of the new cells is provided with the same organs as the old cell had.

Every cell has in it a nucleus. But the important thing for us to remember here is that those cells which are used for purposes of reproduction have only half of a complete nucleus. For this reason the reproductive cells, generally speaking, are incapable of growth until they have united with another reproductive cell, and thus acquired a whole nucleus.

The reproductive cells, with their half nuclei, are produced by a very different kind of cell division from that which occurs in ordinary growth. Instead of each of the parts of the nucleus dividing, as is the case in ordinary body cells, the parts of the nucleus separate into two groups, so that the reproductive cells which are formed at this division have only half of a nucleus in them. Now it is in this peculiar cell division, which results in the production of reproductive cells, that we find the cause of Mendel's law. Let us now return to our pair of antagonistic characters. Suppose we have a plant which is a hybrid between a red pea and a white one. Every cell in this hybrid plant has both of these characters present in it. But when the reproductive cells are produced, when the nucleus is separated into the half nuclei, we find the red flower character in one of these half nuclei, and the white flower character in the other. Thus half of the newly produced reproductive cells contain the red and half the white flower character. We thus see why we call this law the "law of separation of character pairs." Every pair of antagonistic character present in a hybrid is thus separated at this particular cell division.

Let us see now how many and what kinds of seed our hybrid pea produces. Our plant produces reproductive cells in two different places. In the little pod in the center of the flower it produces certain cells called ovules. These contain only half a nucleus, and can not grow and divide in this condition. Half of these ovules contain the red flower tendency, the other half the white. The pollen grains produced in the anthers are likewise reproductive cells. These are also half red and half white; by this we mean, of course, that half of them contain the red flower character, the other half the white flower character.

These pollen grains fall on the stigmas at the top of the little seed pod, and grow down into the tissue of the pod until they come in contact with the ovule. Then the half nucleus of the ovule united with a half nucleus from the pollen grain, and we have a new cell with a whole nucleus. This cell then begins to grow, and soon a seed is produced.

Figure 2. RED PEA X WHITE PEA.
2ND GENERATION.

Thru Ovule	Thru Pollen.
½ R	¼ R - ¼ RR ¼ W - ¼ RW
½ W	¼ R - ¼ RW ¼ W - ¼ WW

¾ Red; ¼ White.

Fig. 2 shows us how many kinds of seed our hybrid plant can produce. Half of its ovules are red and half white. We can readily see that the red ovule is just as apt to unite with red pollen as white pollen, hence, on the average, half of the red ovules will unite with red pollen and half of them with white. Likewise, half of the white ovules will unite with red pollen and half with white. We thus have four cases, namely: red uniting with red; red with white; white with red; and white with white. Each of these four cases is as likely to occur as another. Hence, on the average, they will occur an equal number of times, especially if the number of seed produced is large. Thus we see that the progeny of our hybrid is one-fourth pure red, one-half hybrid between red and white, and one-fourth pure white. But since the hybrids also produce red flowers, the progeny of the hybrid we are considering will be three red to one white. This is the well known Mendelian ratio found in the progeny of a hybrid plant or the progeny of two hybrid animals.

We must now get acquainted with two very big words, because we have no little words that fit the case. The first kind of seed shown in Fig. 2 is formed by the union of red with red. This seed, and the plant it produces, is said to be homozygote, a word derived from the Greek and meaning "like things united." The fourth kind of seed is seen to be homozygote for white. The second and third types consist of unlike things united, and are therefore said to be heterozygote. We shall have to use these words frequently in what follows.

As the separation of character pairs is highly important, I will take the liberty to use another illustration. Suppose that the parents of a family of children are both heterozygote for brown eyes and blue eyes. Since brown is dominant to blue both these parents will be brown-eyed, but each of them will transmit brown eyes to half the children and blue eyes to the other half. (Fig. 3.) The possible types of children in such a family are illustrated in Fig. 3. The first group consists of children which inherit:

Figure 3.—2ND GENERATION OF BROWN X BLUE EYES.
Br-Brown; Bl-Blue.

1. Br fr. F. & Br. fr. M.-BrBr.
2. Br. fr. F. & Bl fr. M-BrBl.
3. Bl fr. F. & Br fr. M-BrBl.
4. Bl fr. F. & Bl fr. M-BlBl.

(1) Brown eyes from the father and brown eyes from the mother. This group is homozygote for brown eyes.

(2) Brown eyes from the father and blue eyes from the mother.

(3) Blue eyes from the father and brown eyes from the mother.

(4) The last group inherit blue eyes from the father and blue eyes from the mother. Being homozygote for the blue they will be blue-eyed.

Each of these four cases is equally likely to occur. The first three of them give brown eyes, the last blue; hence, on the average of a large number of such families, three-fourths of the children will be brown-eyed and one-fourth of them blue-eyed. Many of you will know families in which this law is illustrated. It must be remembered, however, that in such families all the children may inherit either brown or blue from both parents, but such cases will be rare. It is possible from the law of probability to calculate in what proportion of such families any particular combination of brown and blue eyes will occur.

Let us now return to the case of the Imperial Primrose. This beautiful purple flower originated in a cross between a red and a white variety, the heterozygote being purple. Now, when this purple plant produces ovules and pollen, half the ovules carry the red character and half white. Likewise, half the pollen carries the red character and half the white. The chance union of these pollen grains and ovules covers the same four cases we have considered above in the case of eye color. One-fourth of the seeds produced are homozygote for red; one-half of them are heterozygote; the remaining fourth are homozygote for white. We can now understand why this primrose, grown and sold by an English florist for a period of fifteen years, always produced some red, some white, and some purple progeny. Generally speaking, one-fourth of the seed produced red flowers, one-fourth white, while half of them reproduced the beautiful Imperial Primrose (Blue Andolusious).

Experience has shown that it is impossible to fix the type of a heterozygote by selection, and we now know why this is the case. It is because of the law of separation of character pairs when reproductive cells are formed. How, then, shall the breeder of plants and animals secure any advantage from this law?

LAW OF RECOMBINATION.

We come now to a third law which is immensely more important than either of the two already considered; but since it is, in part, a direct consequence of the second law it has not usually received separate treatment by writers on this subject. This third law is the law of recombination. It may be stated as follows: In the offspring of a hybrid there will be found every possible combination of the characters of the original parents of the hybrids. This presupposes, of course, that the progeny are numerous enough to permit each of these combinations to occur.

For example, Hereford cattle are horned and have white faces. Polled Durham cattle have colored faces and are hornless. If we cross these two breeds, the calves inherit both white face and red face, both horns and no horns. Because of the law of dominance the crossbred calves will exhibit white faces, and they will also be polled, i. e., hornless.

Figure 4.—PROGENY OF HEREFORD POLL DURHAM CROSS.

1. Colored face and horns.
2. Colored face and poll character.
3. White face and horns.
4. White face and poll character.

Now the calves of these crossbreds will present every possible combination of these characters. (Fig. 4.) For instance, some will have colored face, with horns; some colored face, without horns; others have white face and horns, while still others have white face without horns. It will be noticed that type 2 is like the original Polled Durham parent, while type 3 is like the Hereford. But types 1 and 4 are entirely new. Type 4 has all the marks of a pure Hereford except that it has no horns.

The importance of such a case as we are considering is easily seen when we remember that horns on cattle are worse than useless ornaments. Buyers at the great cattle marts pay half a cent a pound more for hornless beef cattle than they will for horned, for they know that a carload of horned steers will show many bruises that injure the meat.

Many breeders of Shorthorn cattle long ago recognized the value of the poll character, and the Polled Durham cattle is the result. These cattle are simply Shorthorns with the horns bred off. Hereford breeders were slower to recognize this point, but we now have a breed of Polled Herefords produced exactly as described above, i. e., by crossing Polled Durhams with horned Herefords. Fig 5 shows a calf of this breeding. Good individual Polled Herefords sell for twice as much as the horned kind.

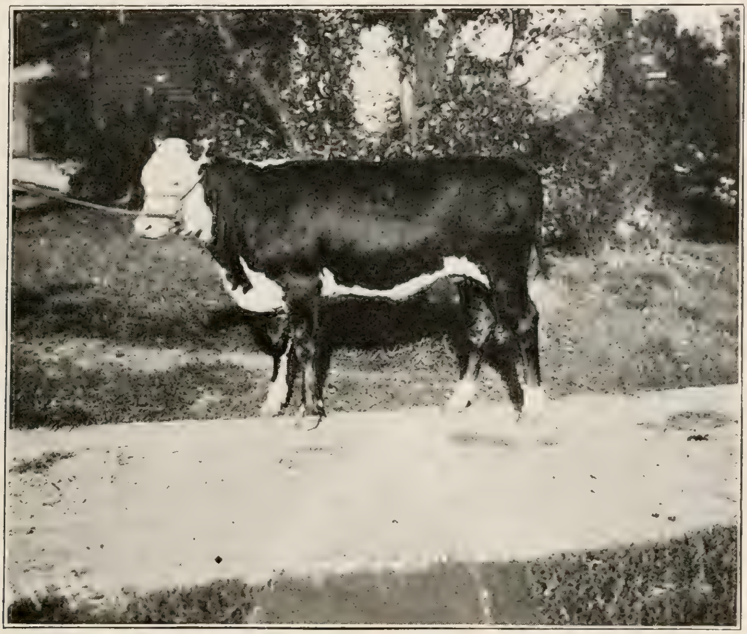


Figure 5.—Hereford—Poll Durham Cross.

There have always been a few polled animals amongst pure Herefords. Breeders of these cattle formerly considered it a great misfortune when a polled calf was born. Now these pure Polled Herefords are almost priceless, because we know that by means of them horns can be eradicated from the whole breed; and this is being done as rapidly as possible.

We see, therefore, that our newly acquired knowledge is not merely a scientific curiosity. It is already being applied with highly important results, though it is only eight years since knowledge of those laws became general.

There is one other very important point about the law of recombination that must be made clear. Let us recall that according to this law the progeny of hybrids will present every possible combination of the original parents of the hybrids. In the Hereford-

Polled Durham cross one of these combinations was white face and no horns. But that is not all; some of these white faced calves will be homozygote for white face; that is, they will have inherited this character from both parents; others will be heterozygote. The homozygotes will transmit white faces to all their progeny, while the heterozygotes will transmit it to only half their progeny. The total number of combinations in the second generation of the hybrid is shown in figure 6. Here we have nine types, but they can not all be distinguished by external characters. For instance, types 2, 3, 5, and 6 will all have white faces and no horns. But these nine types all differ in their inheritance, and hence no two of them will transmit exactly the same characters to their offspring. The most important point of all is that every one of the four visible types shown in Fig. 4 is found absolutely pure in one of these nine types. For instance, type 1 (Fig. 6) is homozygote for both face color and horns. Similarly, types 3, 7 and 9 are all pure types and will reproduce true to type. We may, therefore, add to the already important law of recombination the still more important fact that, in some individuals, if the progeny be numerous enough, every possible combination of characters will be found in a pure form that requires no further selection to fix its type. Nothing more important than this has ever been discovered in the whole realm of biology.

Figure 6.—PROGENY OF HEREFORD POLL DURHAM CROSS.

	Face	Horns
1.	WW	HH
2.	WW	Ph
3.	WW	PP
4.	Wr	HH
5.	Wr	Ph
6.	Wr	PP
7.	RR	HH
8.	RR	Ph
9.	RR	PP

This phase of the law is beautifully illustrated in some recent work in the breeding of tomatoes done by Professors Price and Drinkard of the Virginia Experiment Station, the results of which I am now able to show you in the lantern slides.

The parent plants used in making this cross differed in three important characters. One of them had green leaves, the other had yellowish leaves; one had yellow fruit with a neck on it, rendering it pear-shaped, the other had red fruit which was round, or without neck. We thus have three character pairs, namely, green and yellow leaves, red and yellow fruit, neck and no neck on the fruit. The possible combinations of these three characters that can occur in the second generation of the hybrid are as follows:

First, we may have either green leaves or yellow leaves. In each of these classes we may have yellow fruit or red fruit, and in each of these subclasses we may have the neck or its absence. This gives eight types. The second generation of the hybrid consisted of these eight types, and of nothing else. Two of these types were like the original parents, the remaining six represented new combinations of the characters of the parent varieties. The great value of our third law lies in the fact that by means of it we are able to secure any desired combination of characters that can be found in plants or animals closely enough related to permit of crossing.

Let us now return to the case of the hybrid wheats mentioned above. In the State of Washington, which is a great wheat growing region, the only wheats the farmers had ever found satisfactory were three varieties of spring wheat. The winter wheats that had been tried would not stand up and would shatter their grain easily. These three varieties of spring wheat were nearly always sown in the fall, because when they did go through the winter they would yield 50 per cent more from fall sowing than from spring sowing; but about every third year they would freeze out. Farmers were eager for a good variety of winter wheat. At the Washington Experiment Station, with which I was connected at the time, we secured a large number of varieties of winter wheat, tested them five years to determine which were best, and then crossed eleven of the best winter varieties with two of these spring varieties, hoping to combine the winter character with the stiff straw and hard chaff of the spring varieties. In this we were completely successful. The Washington State Experiment Station is now growing a large number of these hybrids, having selected out the homozygotes, thus securing new and fixed types of winter wheat eminently adapted to the peculiar climatic and soil conditions of that region. Last year a few of the best of these hybrids were distributed to the farmers. The reports this year indicate that they outyielded all other varieties against which they were tested, and the farmers are very enthusiastic about them. Twelve thousand acres of these wheats have been sown this fall (1908). Thus, Mendel's law is not simply a plaything, but is a discovery of fundamental importance. It has already had important applications, and that it will have many others can not be questioned.

The next figure (Fig. 7), shows some of these hybrid wheats. In the top row are shown the two parent varieties, Little Club and Valley. On the left hand Little Club was used as the pollen parent; on the right hand Valley was the pollen parent; but the results in both cases were the same. At the extreme left are shown three of the hybrids produced by using Little Club as the pollen parent. To the right of each of these three is shown, in the left half of the picture, the progeny of that particular plant. It will be seen that part of them are long like the Valley, part short like the Club, and

WHEAT HYBRIDS—FROM WASHINGTON STATE EXPERIMENT STATION, PULLMAN, WASHINGTON.

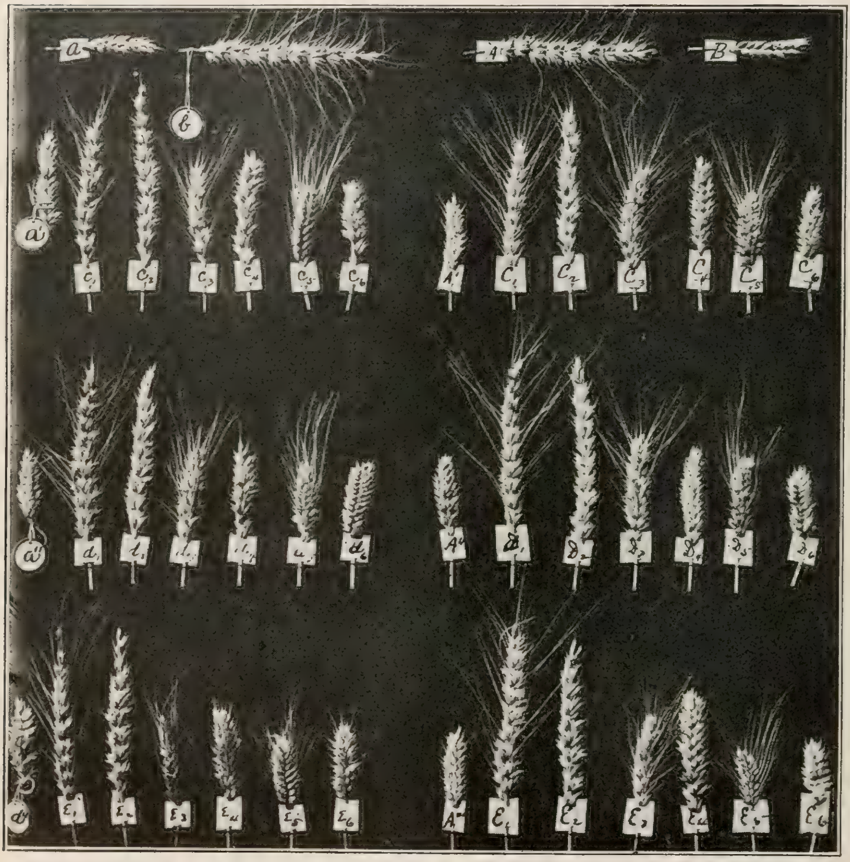


Figure 7.

a—Little Club, Male parent.
b—Valley, female parent.
a′ a″ a‴—Hybrids (a x b).
c_1—c_6—First generation from a′
d_1—d_6—First generation from a″
e_1—e_6—First generation from a‴

A—Valley, male parent.
B—Little Club, female parent.
A′, A″, A‴—Hybrids (A X B).
C_1—C_6—First generation from A′
D_1—D_6—First generation from A″
E_1—E_6—First generation from A‴

part intermediate. The long are homozygote for length, the short are homozygote for Club character, while the intermediates are heterozygote. In each of these three classes based on length, some individuals were bearded and some were smooth, and this occurred in the descendants of every one of the first generation hybrids. Exactly the same conditions are seen in the right half of the figure. It was, of course, not possible to illustrate in this figure the valuable winter character which we succeeded in engrafting on wheats which otherwise can not be distinguished from the Little Club variety. It should be stated that these new wheats are of better quality than Club wheat, and sell for one cent a bushel more.

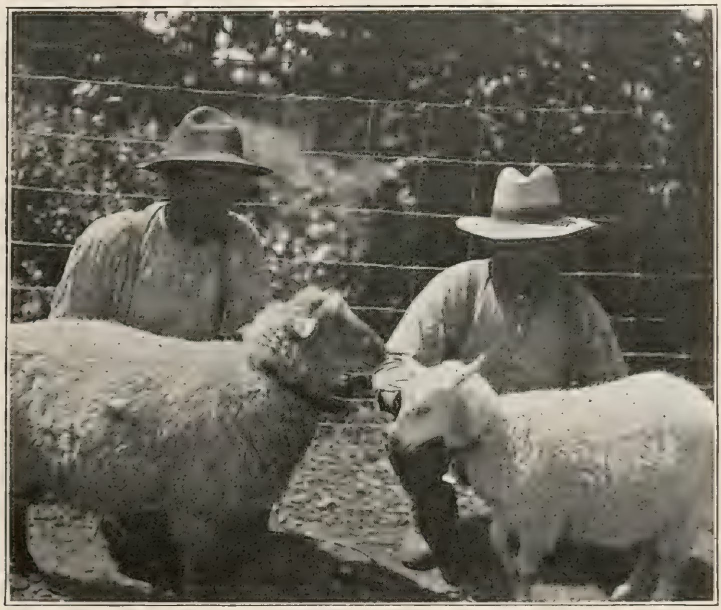


Figure 8.—Twins—a sheep and a goat.

The last of our lantern slides is of peculiar interest. These two animals are twins. One of them is a sheep and the other a goat, of course a heterozygote. I have the complete history of this pair of twins and the photographs of their dam and of the two sires, and there is practically no doubt of the correctness of their history. There is no particular economic interest attached to this case, but there are several points of great theoretical interest, which I have not time here to mention.

CONCLUSION.

It is now clear that we have discovered three important laws which apply, if not to all hereditary characters, at least to practically all which have been studied. First, we have the law of dominance, the one of the three laws which is most limited in its application. According to it when two naturally opposite characters meet, one of them shows and the other does not. Second, we have the law of segregation of character pairs, according to which an individual transmits to half of its progeny a particular character received from one parent, and to the other half the corresponding form of this character received from the other parent. Third, we have the law of recombination, which is the most important of all. According to this law the grandchildren of two individuals, if sufficiently numerous, present every possible recombination of the characters of these individuals.

We do not yet know all of the characters in any species that obey the above laws. One of the important tasks of the breeder at the present time is to ascertain what these characters are; that is, to find those characters which pass from one generation to another without going to pieces. When this has been done, we shall have placed in our hands the power of creating many new and valuable forms.

We have seen that these laws apply to the physical characteristics of man. Let us also see whether they apply to intellectual and moral characters. Fortunately, we are not without evidence on this point. Dr. Frederick Adams Woods of Connecticut has devoted many years of patient study to an investigation of this question, which has recently been published under the title "Heredity in Royalty." He chose the royal families of Europe for this study for two reasons; in the first place, the ancestry of royal personages is carefully recorded; furthermore, enough written record has been left concerning the individuals to enable us to form a satisfactory estimate of their intellectual ability, and of their moral character. After long and patient study, Dr. Woods was able to grade some 800 of these personages, either for intellectual or moral character or both, thus giving a basis for comparing intellectual ability and moral character of parent and offspring. This second reason for choosing royal families for this study lies in the fact that environmental influences may be assumed to be more uniform amongst these people than amongst any other class.

Now for the results. He finds plenty of evidence, though Dr.

Woods does not recognize this himself, of the law of dominance. For instance, either genius or insanity may be transmitted from grandparent to grandchild without appearing in the intermediate gnerations, presumably because in that intermediate generation it met its dominant opposite. The law of segregation of character pairs and of the consequent recombination is fully recognized by Dr. Woods. For instance, if the individuals in the pedigree of a family of children are uniformly of high intellectual ability or the opposite, then all the children will be alike in this respect. On the other hand if some of the ancestry is of one type and some of another, then in the family of children we find some individuals of both types, which is just what we should expect from the law of recombination. But the evidence is even more conclusive. According to Galton's law, which was developed from the study of physical characteristics, such as color of hair, color of the eye, stature, etc., the degree of resemblance between parent and offspring is known to be on the average 30 per cent. Taking the grades assigned by Dr. Woods to the various individuals he studied and applying the formula to them, the degree of resemblance in intellectual ability between parents and offspring is exactly 30 per cent. The corresponding degree of resemblance for moral character is 29.57 per cent, which is so near the exact result called for by theory as to answer all practical purposes. In other words, the difference may be set down to experimental error. It is clear, therefore, that the native ability and the natural impulses of human beings are as much a matter of heredity as are any physical characteristics.

The following striking fact immediately confronts us when we recognize the truth of the above statement. Prodigious effort has been made by the human race to better its condition, but this effort has been wholly in the direction of improving the environment. While Dr. Woods has shown that this is really an unimportant factor in determining character and ability, it is true that when environment is unfavorable it may prevent the development of natural tendencies or may warp them, and it may also result in great natural ability remaining practically useless for a lack of the implements which a full development of intellectual powers would place in its hands. But improving the environment does not from generation to generation give better material for our schools to work on. We have been dealing with the wrong problem. The plain and evident course to pursue is for us to be more careful in the choice of our parents and grandparents.

It may be of interest to know that one state at least, namely, the State of Indiana, has during the past year, taken steps to make direct application of the principles here stated, at least in preventing children from choosing as their parents idiots, imbeciles, and certain classes of criminals. This is an important step and one whose general application can not much longer be delayed in the interests of future generations. There is reason, therefore, to hope that when we get through improving plants and domestic animals we may progress to a point where we can apply these important principles in improving a certain wild animal known to biologists by the dignified title of *Homo sapiens.*

LIVE STOCK AND AGRICULTURAL CONDITIONS IN ARGENTINA AND HOW THEY AFFECT THE AMERICAN LIVE STOCK INDUSTRY.

(By Prof. H. W. Mumford, University of Illinois.)

The attention of the entire world has been called to Argentina as a rapidly growing and exceedingly important factor in the world's supply of beef. For many years the United States of North America has been the chief factor in the export trade of this commodity. Today the Argentine Republic must be looked upon as an

Figure 1. Frigerificio cattle of the Export Chilled Beef type.

equally important factor in the world's market. "There is perhaps no other area in the world possessing so vast an area of rich land on which, owing to the exceptionally favorable climatic conditions, live stock is born, bred and fattened entirely on the prairie without need of artificial shelter, and there is scarcely no other where animals feed exclusively on natural grasses the soil of which can be tilled at any time of the year."

The beef cattle population of the Argentine at present is variously estimated at from 26,000,000 to 30,000,000. In the United States there are 50,073,000 cattle other than dairy cows. The Argentine Republic is about one-third the area of the United States and by some is believed to possess two-thirds our capacity for producing food products. Then there is the significant consideration of the relative population of the two countries. While the United States perhaps has 80,000,000 inhabitants Argentina has approximately 5,500,000. This forces Argentine farmers to depend very considerably on foreign markets as an outlet for their products. Whatever may have been the condition of the past, indications at present point strongly to the fact that Argentines are alive both to the necessity and privilege of developing foreign markets for their large and ever increasing surplus.

In 1880, the only exports were the by-products of live stock. Exclusive of meats only sufficient food stuffs were produced to feed its meagre population. Today their exports to Great Britain of beef, mutton and wheat exceed our own, notwithstanding the fact that less than fifteen per cent of the arable lands are under cultivation. It is estimated that there are over 250,000,000 acres of arable land in the Republic. According to the latest statistics (1907), the area under cultivation was but a trifle more than 36,-000,000.

Traveling through the country by train or coach the impression that there is but little agriculture as compared with what is possible grows upon one. Examples of good farming in the light of methods followed by the more progressive cornbelt farmer are seldom seen.

Cattle men of the United States are vitally interested in the question of the extent and nature of Argentina's export trade in beef and to how great an extent will their production influence the demand for our cattle abroad. First let us examine the exact condition of their trade as compared with that from the United States. The following statement will show the exports of beef to Great Britain for the years 1905, 1906 and 1907.

Year.	From United States.	From Argentina.
1905	2,231,206 cwts.	2,580,152 cwts.
1906	2,426,644 cwts.	2,795,913 cwts.
1907	2,417,604 cwts.	2,691,544 cwts.

The figures for United States exports include live cattle and chilled beef, those from Argentina only chilled and frozen beef as the ports of Great Britain have been closed to live cattle from Argentina for about five years. At that time the danger of such cattle causing outbreaks of foot and mouth disease was so great that the ports were closed (May 1903) to all live cattle from Argentina. While the opening of the ports would undoubtedly aid the Argentine cattle raisers it is not probable that they will ever be opened again and from the standpoint of the beef producers of the south land, there is far less need for the restoration of this live cattle trade now that there are at least thirty-two steamers equipped with cold storage accommodations.

Figure 2.—Purebred but unpedigreed shorthorns, Estancia "La Pastoril."

Only the highest grade of cattle produced in Argentina, that is the well bred and well fattened, are used for export. The best of these are chilled and the remainder frozen. About 28 per cent of the beef exported from Argentina is chilled. All of the Argentine export mutton is frozen. It is estimated that Argentine slaughtering establishments have practically three-tenths of the killing capacity of the world. The plants which slaughter cattle which are chilled or frozen for export are called frigorificos. In 1903, when the British ports were closed to live cattle there were but three of these establishments in Argentina, now there are seven. The saladero or "jerked beef" establishments of twenty years ago have been gradually disappearing as more modern methods of handling meat have been introduced. This indicates the progressive tendency of the country and the great improvement that has been wrought in the cattle. As late as 1894 2,000,000 were killed in the saladeros of beef salting factories of Argentina; in 1901 only 403,000 and in 1907 about 270,000. It is true that much of the saladero industry has been transferred to Brazil, Uruguay and Paraguay. However, about one and a half million cattle represent the entire number of cattle slaughtered in these establishments in the four countries named.

While the number of beef cattle in Argentina, the most prosperous southern republic, does not seem to be increasing, improvement in quality has kept pace with the extension of the area under cultivation. During the past ten years the area under cultivation has increased 167 per cent, railway mileage 36 per cent and the population 42 per cent. Many Argentine estancieros have spared no trouble or expense in attempting to improve the common stock of the country. This has been accomplished chiefly by importations of high class pedigree beef and dairy cattle from Great Britain. It is an historical fact that the cattle breeders of Argentina, and more especially the breeders of registered beef cattle, have bought the best Great Britain has produced, without much reference to the prices it was necessary to pay. As a result, in place of the old native cattle estancias are stocked with mestizo (half breeds), and in many cases more highly improved stock. In several instances large herds of cattle were seen which were being bred for selling to the frigorificos that were practically pure-bred.

Shorthorns (more frequently called Durhams in the Argentine Republic) are by far the most numerous and popular breed although some fine herds of Herefords and Aberdeen-Angus exist. The luxuriant pastures in many sections seem to be especially favorable for the production of most excellent beef cattle.

There is considerable strife among the principal breeders of pedigree beef cattle occasioned by attempts to bring out prize winners at the live stock shows, the chief one of which is an annual affair at Palermo, Buenos Ayres. This exposition, in point of number and quality of its exhibits, ranks with similar institutions in the principal live stock producing countries.

Of the cattle produced for slaughter the best are sold to the frigorificos, where they are either chilled or frozen for export. There is no absolute standard set by these establishments as to the quality and condition necessary for their trade, as considerable variation in the quality and degree of fatness occurs, owing to available supplies and foreign demand.

Demands in the way of breeding and finish in cattle for consumption in the Argentine Republic are not exacting, and as a rule, a cheaper less improved half-fat class of cattle is slaughtered to supply local butchers. Discarded cows and work oxen are frequently important factors in this trade.

The municipally-controlled new mataderos or market and slaughtering establishment in Buenos Ayres is creditable. The government veterinary inspection at this plant, as well as that at the frigorificos and fabricas, is to be commended as contrasted with the slovenly methods in common use in isolated sections where competent government inspection is unknown. Ample provision has been made for slaughtering cattle, both for domestic consumption and for export, and these establishments are conveniently located both for caring for the bulk of the city and export trade and for providing sanitary conditions.

Cattle raising in Argentina is distinctly a pasturing proposition. The feeding of corn or other grain to fatten or finish cattle for the market is not practiced. A few years ago, some experiments along this line were tried by estancieros or ranchmen, but the practice was abandoned because it did not pay. Frigorificos would not, perhaps could not, afford to pay enough more for cattle so fattened over the grass or alfalfa-fattened cattle to make it possible for the estanciero to get market price for the corn used in finishing.

An abundance of well bred cattle and a good and increasing supply of corn in the country simply await the time when conditions are favorable for converting the corn into a higher grade of beef instead of exporting relatively such a high percentage of the crop.

Cattle raising for beef in that country, especially in the temperate zone, is a much more favorable industry than in the United States. The climate makes it possible for the entire life of cattle to be spent out of doors without shelter and generally without shade of any kind. The suitability of a very large acreage for the growth of alfalfa and other nutritious grasses and legumes, together with cheap land and labor, make it possible to produce beef cheaply. To any one unacquainted with the possibilities of the country the degree of fatness which the cattle acquire on grass or alfalfa alone is a marvel.

Figure 3.—Ranch and Cattle scene, Estancia "Los Algarrobos."

There is quite an extensive area well suited to, and at present partially used for, the growing of corn; but as yet, and probably for some years to come this product will either be exported or used for horse, dairy cow and pig feeding. If the time ever comes when slaughterers will pay a sufficiently high premium for corn-fed beef, it is believed the country can produce ample corn for this purpose.

A statement of the distribution of cattle throughout the various provinces of the republic will serve to show what parts are considered best adapted for cattle raising. In some instances these statistics might be misleading, as for example, in the province of Buenos Ayres and other favored sections of the country more cattle might be kept, but agriculture is more profitable.

From the accompanying map it will be seen that the Provinces of Buenos Ayres, Corrientes, Entre Rios, Santa Fe, and Cordoba are at present the leading cattle sections. These five provinces contain upwards of 80 per cent of the cattle in the Argentine Republic. Cattle ranches are large, those of from 12,500 to 25,000 acres in extent being common, while those of 200,000 acres are not unknown. Alfalfa, which grows luxuriously over a large part of the Argentine, is yearly becoming more and more the cattle raisers' mainstay. Approximately 9,000,000 acres are devoted to this crop and this seemingly large area by no means represents the extent of its probable use, as its growth is rapidly increasing. Alfalfa is pastured with cattle, sheep, horses and hogs. As a rule only the surplus is cut and stacked for hay. If the entire crop is left for hay it can usually be cut five times and will yield five tons or more for the season. Ranches well set in alfalfa and intelligently handled will graze 4,000 cattle, 1,000 sheep and 100 horses the league of 6,672 acres. Alfalfa is by no means a new crop and notwithstanding the rapid extension of its growth, its wealth producing possibilities are not yet fully appreciated by our southern neighbors, else its culture in Argentina would be universal.

To emphasize the importance of this crop to the Argentine beef producer, a single instance will suffice. A progressive Englishman assumed the management of an estancia of some 140,000 acres in extent. That was thirteen years ago. At that time the pastures were simply of the native grasses. As the estancia was owned by a stock company it was divided and subdivided and parts of it were sold until today but 55,000 acres remain. This is all well set in as fine alfalfa as it has ever been my privilege to see. This

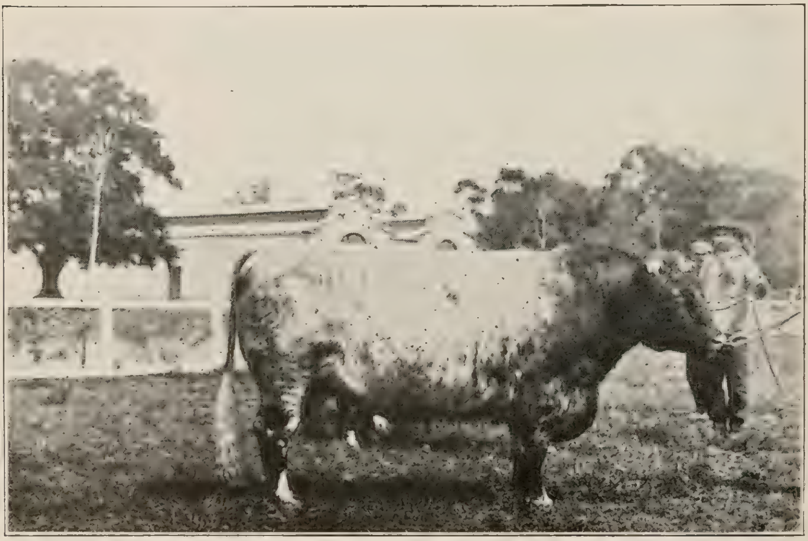


Figure 4.—"Conquerors Crown"—An Argentine-bred bull which would look well in high-class company in any country.

55,000 acres supports as many cattle and sheep as the original 140,000 acres before the adoption of alfalfa.

As seen from some points of view it would seem that the Argentine Republic is not favorably located for developing an extensive and profitable export trade in beef, closer study shows that their slaughtering establishments can be and are located within easy access to the most-favored cattle-producing sections, and also at or near seaports having direct and frequent communication with British and European ports. It costs no more to deliver a carcass of beef from Argentina to the London market than from Chicago.

It should not be expected that the beef produced in the Argentine on grass alone will grade in the market as high as English, Scotch, or corn-fed beef from the United States of North America. Notwithstanding this beef is being produced and in the manner mentioned, that sells in the English market within two to three cents per pound of the corn-fed beef from the United States.

Some discouragements await the Argentine beef producer, although they may be of a quite different character than those elsewhere experienced. For example, a few years ago, owing to an outbreak of foot-and-mouth disease and the consequent supposed prevalence of this disease in the Argentine Republic, the ports of Great Britain were closed to the importation of Argentine live cattle. There is very little, if any, of this disease in Argentina at the present time. In fact it does not seem to be a serious handicap to cattle raising there except as mentioned. Cattle raisers there have even gone so far as to suggest the possibility of its being prevalent in a herd without its presence or effect being especially manifest. Other discouragements are found in the way of ticks and a form of anthrax commonly spoken of as carbuncle. Added to these diseases the estanciero may wisely anticipate more or less frequent drouths. Notwithstanding all that may be said with reference to the difficulties encountered in cattle raising, it is still a favored and favorite industry in the Argentine Republic, as is shown by the number of men engaged in it and their prosperous condition.

THE PROBLEM OF FARM FINANCE IN ITS RELATION TO PERMANENT AGRICULTURE.

(Byron McFarland, Monroe City, Mo.)

It seems to be the policy of those in charge of arranging the programme for these meetings, to enlist the services of all the talent available; but sometimes they are a little short on talent and a little long on time, and then it is that they are compelled to call in a few time-killers. That explains why I am here today. I have come over to help you while away your time, and to try to whet your appetite for the more weighty mental problems to which you shall be treated; and if I can serve you to no other purpose than to create in you such a hungering and thirsting after knowledge that you will be able to digest and assimilate all the good things in the feast to follow, without an acute attack of intellectual indigestion, I can not feel that I have spoken in vain.

Now, I have been asked to speak upon the Finance of Farming, but as I am not on very intimate terms with finance in any form, I have thought it well to make the mystery more complete by adding a little to the subject. In this way I hope to be better able to fulfill my mission as a time-killer. I have decided, therefore, to try to talk to you a while upon "The Problem of Farm Finance in its Relation to Permanent Agriculture."

It is with considerable hesitation that I undertake to address you upon this subject, because I feel that what I shall have to say will prove a disappointment—that I shall not be able to say what you have a right to expect me to say; and greater is my hesitation, because I feel that what I shall say will not only not be accepted, but may subject me to general, perhaps severe criticism. And while I do not expect, or even desire, you to accept a new doctrine too readily, yet I have thought a presentation of the subject, as I see it, might not prove amiss at this time.

The conclusions at which I have arrived are, with me, at least, strictly original; and, I may add, they may be just as strictly erroneous. So that all I ask of you tonight is to lay aside your own views for the present, and to try to look at the subject from my point of view for a few minutes.

The fundamental facts upon which the problem of farm finance rests, are the cost and the selling-price of farm products; and all of our investigations so far, have been in the direction of reducing the cost by improved methods of production, or of increasing the selling-price by indirect methods of selling. But our investigations have been based upon the assumption that the farmers themselves have it in their power to solve the problem in a satisfactory way, and, according to our present popular point of view, if the farmer fails to prosper, the fault is his, and his alone. Now I should like to talk to you a while about whether or not the average Missouri farmer is really prosperous, and if not, whose fault is it.

The cost of farm products is measured and determined by three factors: (1) interest on the investment; (2) labor incidental to growing, harvesting and marketing the crops; and (3) soil fertility removed by the crops.

As for interest on the investment, I am of the opinion that it is no more than common-sense and business justice that the man who puts his money in land is entitled to as much interest on it as the man who loans his money on gilt-edged land security. The present rate of interest the farmer has to pay, with ample security, is from 5½ to 6 per cent; that is, the man who loans money clears about 50 per cent above taxes, and ordinary justice would indicate that the farmer who invests in land should be entitled to 50 per cent above taxes. Now this, remember, he is entitled to without labor. The money-lender draws his interest without any special labor, and so should the land owner; he should get the amount of his interest over and above the price of taxes and labor.

As for the labor part of the proposition, I believe it fair to suppose that the labor of the farmer is worth at least as much as that of his hired man, especially if his head work is thrown in for good measure. This needs no argument, for it is a truth as old as humanity that the laborer is worthy of his hire whether he works for another, or for himself. It is so regarded in other walks of life, and it must be so regarded in agriculture.

The question of soil fertility removed by a crop is comparatively new to most of us. It is a question not thoroughly understood even by experts. With fresh, fertile fields, the question of lost fertility never arose, but time and failing crop yields have brought the matter home to us; and the idea of including lost fertility in the cost of a crop, is rarely met with. Now, if fertility were inexhaustible, if our soil never could wear out, then, and then only, could this important item be left out of our calculations. But the fact that soil fertility is limited, that a fertile field may be made poor even in a single generation, makes this item a most important one in our considerations of cost. Indeed, the problem of maintaining our soil fertility has recently become, and is today, the paramount problem of American agriculture; for if we can not keep up the fertility of our soil, our days as a nation of agriculture are numbered; not that the total amount of plant food in our soil can be cropped away in a few years, but that reduction in fertility is followed by such rapid reduction in crop yields that the element of profit disappears long before the soil is completely exhausted. So that, to make agriculture permanent, the fertility must be maintained.

Now as to the manner of keeping up fertility, there are some very vague and erroneous ideas. The popular idea is that rest restores land. When we crop a piece of land pretty hard, and it becomes unable to produce a satisfactory crop, we say that it is tired, and needs a rest; but recent research has shown that it is not only tired, but *hungry*. When we work a horse hard all day we say that he is tired, but we have learned by experience that it is a pretty good idea to give him some corn and hay to help him rest up on; and we have also learned that if we rest him every night and give him plenty of feed, we can work him right along the year round. And so it is with our land—it does need rest, but it needs feed as well, and it takes both to keep up its ability to produce.

The next step of progress in our idea of maintaining soil fertility is the idea of rotation of crops. The reduced yield on land continuously cultivated to one crop, was explained by saying that the land was "sick" toward that crop, and that a rotation with other crops would make it well again. This idea is, in substance, like that of the man who takes his horse out of the plow at night, and drives him to town, without feed, to rest him up. What the horse needed most was not so much a change of work as a change of diet. A horse was never made fat, nor a field fertile, on a diet of aqua pura and atmosphere.

Another important step of progress was the idea not only of rotating the crops, but of including in the rotation a crop like clover or cowpeas, that has the power of taking nitrogen from the air and adding it to the soil. It has been observed after a crop of clover or of cowpeas has been grown on land, that its productive capacity is greatly increased. This discovery was hailed as the final solution of the problem, but recent investigations have shown that even this will not suffice for, although clover may add nitrogen to the soil, it takes away potash and phosphoric acid the same as other crops do, and the seemingly good effects of its growth may be misleading on this point. Professor Hopkins, of Illinois, says: "The only kind of soil treatment in common use (in Illinois) that is even believed to benefit the soil is a crop rotation, including an occasional clover crop. It is a fact, however, that a crop rotation is a means of depleting the fertility of the soil, and clover used in this way in grain-farming serves only as a most powerful soil stimulant, leaving the soil poorer with every passing rotation, until the crop yields become reduced, clover being the first crop to fail in this system." Allow me to quote, also, from Bulletin No. 109, Minnesota Station: "A rotation of crops removes more total mineral plant food from the soil than when a grain crop is grown continuously, and thus a rotation may hasten the exhaustion of fertility." I have quoted these passages from others, because I feel that were I to make the same statements on my own authority, they might not be accepted.

Now, the next step of progress was this: Not only to rotate the crops, with a legume as one of the crops, but to save and apply barnyard manure to the soil. But a chemical analysis of barnyard manure, and of feeds, shows that under average farm conditions only about 50 or 60 per cent of the fertility taken from the soil by the crops can be returned in the form of manure made by feeding the crops on the farm; so that if we feed out on the farm all that we raise, we will still lose nearly one-half the fertility taken up by the crops. Hence, feeding our crops and applying the manure will only retard the loss of fertility, and will not prevent it. Allow me to quote again from Bulletin No. 109, Minnesota Station: "A rotation of crops, with the occasional use of farm manures and the production of clover will not indefinitely maintain the fertility of soils." In this connection, Professor Hopkins says: "Light and infrequent applications of farm manure and only occasional crops of clover act to a greater or less extent as soil stimulants * * * * and thus enable the crops to remove much larger amounts of fertility than are actually supplied by the manure or clover."

We have seen, then, that rest does not restore, that rotation does not return, that clover does not reclaim, that manure does not maintain soil fertility. None of these methods, then, either singly or in combination, will entirely answer the purpose. How, then, are we to maintain the fertility of our soil? There is only one way left—*buy it.*

If you have followed me closely, and have accepted what I have said, and the authorities whom I have quoted, we are now in a position to take up the rational method of studying the cost of farm products. Whenever we sell a bushel of grain, a load of hay, or a pound of flesh from our farm, a certain amount of fertility has been removed; and under present conditions, so far as we are concerned, it is gone forever. But for agriculture to become permanent, this fertility must be returned in some form or other; but in whatever form, a considerable part of it at least must be bought directly or indirectly with money. So that, in view of this fact, I feel compelled to put the fertilizer question upon a cash basis; and in my calculations I have used the prices the farmer has to pay in the open market.

Now, it must be remembered, that there always has been, and always will be, a large amount of grain and feed sold directly from the farm. The advice we so often see in agricultural papers and bulletins to the effect that we should feed our grain and hay and sell only live stock from the farm, is based upon the theory, I suppose, that the genus homo is a purely carnivorous animal; but modern research has confirmed the ancient suspicion that the human organism needs both bread and beef, mush and mutton, pork and pie!

I have prepared a table showing in detail my method of calculating the cost of four staple products of the farm—corn, oats, wheat, and timothy hay. I should like to invite your attention to it for a few minutes, and earnestly request a careful study of it both as to method and as to results. Now, as I have intimated before, I do not claim that the figures on this chart represent absolute accuracy. I have been unable to find satisfactorily reliable data upon the matter of soil fertility removed by these crops; and it is barely possible that the figures I have used are a little high in some instances, but as there is always more or less fertility unavoidably lost beside that taken up by the crop, I have thought these figures may approximate the truth in actual practice. For instance, an experiment (reported in Farmers' Bulletin No. 78) in continuous wheat culture showed a loss of soil nitrogen of over five times that removed by the crop itself.

I have looked up the average yield of Missouri crops in the Year Book of Agriculture, 1906, and have used a ten-year average both for prices and for yields. I have put the price of average Missouri land, that is, the part that is tillable, at $50 per acre, which I believe to be reasonable enough with improvements included. I have made my calculations on a basis of one acre. For the prices of fertilizers, I have used 5 cents per lb. for both potash and phosphoric acid, and 15 cents per lb. for nitrogen. Another point I should mention is labor, for in this table I have included only the time actually put in on these crops which will average about 120 days. I have not included the remaining 180 work days of the year; that is, I have allowed the farmer wages for himself, his hand and his teams for only two-fifths of the time. One other point we should not forget, is that the yields and prices are taken from the most prosperous decade in American history—1897-1906. Now, if any period could show the average Missouri farmer to be prosperous, it should be this period. With these points in our mind, let us now run over the figures of this chart, and see what results we get.

TOTAL COST OF FOUR FARM CROPS.

	Corn, cost per acre, 28 bu. av.	Oats, cost per acre, 23 bu. av.	Wheat, cost per acre, 13 bu. av.	Timothy hay, cost per acre 1 ton av.
Interest on land, $50 per acre at 5 per cent	$2 50	$2 50	$2 50	$2 50
Taxes, fences, etc	50	50	50	50
Breaking ground for crop	1 00	....	1 00	....
Working down and seeding	1 00	1 00	1 50	10
Seed	20	1 00	1 25	15
Cultivating (4 times)	2 00	....	....	....
Harvesting and threshing or stacking	1 12	2 10	2 20	1 10
Hauling to market	70	46	32	1 50
Potash removed at 5 cents per lb	1 10	1 19	57	1 50
Phosphoric acid removed at 5 cents per lb	96	42	44	50
Nitrogen removed at 15 cents per lb	4 98	3 15	3 28	3 30
Total cost per acre	$16 06	$12 32	$13 56	$11 15
Cost per bushel grain, ton hay	57	53	1 04	11 15
Average price received by farmer	35	28	70	7 50
Cost for investment and labor alone	32	33	71	5 85
Cost with yield increased 50 per cent	49	46	87	10 06
Cost with nitrogen at 5 cents per lb	45	44	87	8 95
Cost with nitrogen at 5 cents and yield increased 50 per cent	37	37	71	7 86

We have seen from these figures that the present method of calculating the cost of farm products includes only two items of expense—investment and labor; but the new problem and necessity of maintaining soil fertility, and our inability under any known process to do so without the purchase of mineral fertilizer, compel us at once to change our method of calculation, and to include also the fertility lost by growing a crop. This is, so far as I know, the only rational method. It is also, I may add, the method of common-sense and business necessity. It is a method that should meet with immediate and universal adoption, because it represents a nearer approach to truth than the present method.

Now in applying this method to present conditions, we see that if these figures are based upon anything like fact, if they represent even approximate truth, they show more clearly and more eloquently than any words of mine could show that the average farmer of Missouri is not truly prosperous, and more than that, they show that his lack of prosperity is no fault of his and never has been.

It has been argued that the farmer does not prosper because he follows faulty methods of labor; but I have calculated his labor at a maximum efficiency and for only two-fifths of the time, and yet he plays a losing game.

It has been argued that the farmer does not prosper because he is too wasteful with his crops; but I have shown you that if he sells every grain of his corn, his oats and his wheat, and every straw of his hay, without the loss of a single pound, he still loses money on every crop he grows.

It has been argued that the farmer does not prosper because he neglects to take proper care of his tools, implements, stock, buildings, etc.; but the figures I have used in this chart do not include a single penny for the purchase of implements, work horses or anything of the kind.

It has been argued that the farmer does not prosper because his average crop yield is too small; but I have shown you that were he to increase his yield even to the enormous extent of 50 per cent, he would still be losing money on every acre he cultivates.

And, finally, it has been argued that the farmer does not prosper because he is ignorant; and our whole system of state and national work in the various departments of agriculture is based largely upon this theory. Millions of dollars have been spent, and train-loads of literature and advice have been sent out to the farmer for the purpose of enlightening him so that he may learn how to prosper. The idea seems never to have occurred to us that possibly after all, the real truth might be better stated by saying that the farmer is not poor because he is ignorant so much as he is ignorant because he is poor. Why, if American agriculture were what it should be, if it were put upon a profitable basis as many of our other big businesses are, the colleges and universities of this land would be filled to overflowing with the sons and daughters of our farmers.

Now the reason the average Missouri farmer is not truly prosperous has never yet so far as I know, been told; but it doesn't seem to me to be such a stupendous question to answer, after all. In my humble opinion, he is not truly prosperous because he is not truly making money. And he is not making money because, under present conditions, he cannot make money; and he cannot make money for the all-sufficient reason that he has to sell his products for less than they cost him. And in this connection I should like to suggest that the most vital and pressing need of American agriculture today is not a bigger yield, but a better price for the yield we already have. To put agriculture upon a truly prosperous basis, is the one supreme duty of our country today.

Now I am quite aware that a great many farmers claim that they are making money; and in this claim I know that they are entirely honest. But if there is one question in all the realm of finance upon which a man may be, and is most likely to be honestly mistaken, it is the question of Finance on the Farm.

Every farmer should realize that he has two bank accounts, one which we may call his checking or cash account, and the other his reserve or soil fertility account. Now each of these two accounts, like two ordinary bank accounts, can be increased or decreased at the expense of the other; but it must be remembered that transferring money from one account to another is not a process of creating wealth, and the farmer who draws upon his soil fertility account and deposits it with his cash account, is very liable to imagine that by this process he is really making money. It is poor policy for a business concern to have to draw upon its capital stock in order to pay dividends and it is poor policy for the farmer to draw upon his fertility account in order to make himself believe that he is prospering. Now this is the very thing that has been done, and is still being done by the average American farmer; and just as sure as no business concern can long continue its existence when it is forced to draw upon its capital stock in order to pay dividends, just so sure is the American farmer destined to ultimate ruin, if he must continue to draw upon his soil fertility account in order to show a profit.

Now, I have taken up a good deal of your time in trying to bring you to the point I wish to make clear to you. I have tried to show you that we cannot permanently maintain our soil fertility by any known method of crop rotation, or of feeding our products on the farm; but that even under the best possible farm management, we must buy at least a part of our fertilizer; but if the farmer receives for his products only the cost of his investment and labor, and nothing for the fertilizers in his products, how is he going to buy back these fertilizers? If he does not buy them, how is he going to keep up his soil fertility? If he does not keep up his soil fertility, how is American agriculture ever going to be put upon a permanent basis? And thus the paramount problem of our country, the problem upon which rests the future welfare of every citizen in all this land, the problem of permanently maintaining our soil fertility, becomes and is, under present conditions, practically an impossibility.

If there is one thought in all that I have said, or in what I may yet say, that I would have you remember, it is this: If agriculture is ever made permanent, it must first be made profitable; if we are ever to adopt systems of soil improvement, it must be done while we are prosperous.

Now it may be argued that profitable agriculture would not insure permanent agriculture, that if the farmer received more for his products, he would not spend the increase in maintaining soil fertility.

Doubtless this is true to a certain extent, but we must remember that whether or not he would keep up his fertility if he could, is not an answer to the present question of keeping it up when he cannot. The situation is this: If agriculture were truly profitable he could—as it is he cannot; and common-sense insists that the first means of securing permanency in agriculture is to make this permanency possible, and until we do make it possible, we are of necessity wasting both time and talent in giving the farmer advice along this line. As good as our advice may be, it is a prime essential that we first put the farmer in a position to follow the advice.

Among the many good results that would follow the adoption of a system of profitable agriculture, would be the rapid increase in the number of farmers. The American people are not slow to recognize a good thing, and if they saw that farming was really a good and profitable business, a large number of wage-workers in the cities would come out into the country, buy a few acres and don the "hickory hay." In a few years we should see inaugurated the intensive system of farming—that system which is universally recognized as most nearly ideal—that system which not only yields best returns, but which *does most to* maintain soil fertility. And thus we should approach that ideal national state of society with a more uniform distribution of population, and with the greatest possible number of independent producers of wealth, each working to the best possible advantage.

The large and ultimate duty of the farmer is to feed the hungry, and clothe the naked of earth. The rapid and inevitable increase in population necessitates a corresponding increase in the products of the farm. In the past we have met this necessity by broadening our fields, by reaching out into new territory; but with the taking up of most of our tillable land, and with the end of the distribution of public lands already in sight, the question of increasing the yield on the land we now cultivate becomes at once a vital necessity and whatever means we may adopt to secure this larger yield, whether by better cultivation, or by better seed, it must be confessed that no means will prove permanently effectual that does not maintain the fertility of our soil.

It is not right that one class of our citizens should bear the whole burden of perpetuating our national prosperity. It is a duty and a privilege that should be shared by all alike, and our people will gladly pay the price of this permanent prosperity when once they have been shown the necessity of it.

We as a people have had experience in the wasting of our soil fertility. We have tasted the bitter fruits of that old but empty theory that our soil is inexhaustible. Those vacant, crumbling homesteads of our older states have been stern but effectual teachers and America is learning her lesson. We are seeing more and more the wisdom of conserving our most valuable national asset; and our moral conceptions have so awakened that we can now see that our old system of thoughtless destruction is not only a hazardous business, but a crime against our country. But the old system is doomed. It has had its feast and its revelry, and it has seen the handwriting on the wall! And oh, hasten the day when the abandoned farms of New England shall lift no more their warning voice, but shall stand the silent sepulchres of a policy dead forever in America!

Our national industries have well been likened unto a tree; manufacture and commerce represented by the branches and leaves, agriculture by the roots. Now that part of the tree which attracts the eye, is the part above ground. It receives the credit for all that is good and loved in it. It affords the sweet shade and the delicious fruit. But we forget that the roots reach down into the earth and patiently gather the raw material out of which the beautiful fabric of branch, of leaf, and of fruit, is fashioned; and any injury or benefit received by the root is shared by the rest of the tree. And I have thought that if we as a people cared for this our tree, as did of old that keeper of the vineyard who spared the barren fig tree until he had dug about its roots and manured them well, that of us, also, it might then be said, "They shall be like a tree planted by the rivers of water, that bringeth forth its fruit in its season; whose leaf also doth not wither and whatsoever they do, shall prosper."

Perhaps you are wondering what I mean by making such a talk as this—wondering what can be my motive or mental mood. Now, I do not stand before you as the incarnation of calamity, not as a wailer of woe, nor am I a charter member of the Chronic Kickers' Club; but neither am I a follower of that creed of the fabled Prometheus who thought to lift the burdens from humanity by planting in the hearts of men false hopes. But I stand before you as the professed follower of a diviner doctrine, of a more cheerful creed; and I have tried to preach you a little sermon on my favorite text—"Know the truth and the truth shall make you free." And I leave it to you to say how far I have wandered from my text.

I have not uttered a single word for the purpose of discouraging any farmer, or of making him dissatisfied with his business. I have simply tried to point out to you some of the new problems that we must meet; and great and difficult as these problems may now appear, I look forward to their successful solution with the fullest assurance of hope. Never was the future of American agriculture brighter with promise than it is today. The resourcefulness and ingenuity of the American people have overcome every obstacle; and when we remember how American manufacture with such humble beginnings has, in these few years, leaped to the foremost rank in all the world, who can measure the possibilities of American agriculture when it is, like manufacture, put upon a profitable basis? I cannot believe that the American people will knowingly do that which will prove their national injury. A people who have voluntarily imposed upon themselves a tax in the form of a protective tariff in order that American manufacture may prosper, will not permit the more fundamental business of agriculture to suffer.

No, I am not an apostle of pessimism but rather an avatar of optimism; not a prophet of evil, chanting the doleful jeremiad but rather the voice of one crying in the wilderness, "Make straight the path." And I believe the time will never come when the farmer will fail in that broader and diviner duty of feeding and clothing the world. Whatever obstacles may arise, they shall be surmounted; whatever clouds may cross his skies, they shall be lifted; and there shall be more sunshine than shadow. And the farmer shall push on and on in the fulfillment of his noble vocation, seeking not the greatness of men nor the glory of this earth; but content to stand in that countless throng over yonder, and to be worthy to hear those words of his Christ, "I was naked and ye clothed me; I was a hungered, and ye gave me meat."

MISSOURI'S OPPORTUNITIES IN FORESTRY.

(By Samuel J. Record, Forest Supervisor, Arkansas National Forest.)

It is time every state made inventory of its natural resources with a view to their perpetuation. Our future prosperity depends in large measure upon the care and conservation of our present wealth. Where there is waste, measures are desirable for its prevention; where depletion, there should be plans for replenishing; where exploitation, there should be conservative use.

Missouri is a grand State of many and varied interests. Her seventy thousand square miles support a population of nearly four million people, whose main sustenance is agriculture. Thirty-five million acres are in farms and the value of one annual harvest is a quarter billion dollars. She takes first rank in horticulture, and millions of apple, peach and other fruit trees are yearly adding to her wealth. The natural advantages of favorable climate, fertile soil, and accessible markets are especially conducive to the raising of live stock. In mining, the State plays a most important part, especially in the production of zinc, nickel, lead and iron. Thorough knowledge of these industries is essential to the proper development of the State whose every foot of soil should be devoted to its most paying production.

Missouri's forest wealth is one of her greatest assets, and if properly handled, will prove a source of perpetual revenue and profit. After making due allowance for all the needs of agriculture, horticulture, stock raising and other industries, there remain millions of acres of soils capable of growing forests but worthless for other purposes. It is then paramount that these absolute forest soils be put to a remunerative use, that they prepare to supply Missouri's future timber demand.

MISSOURI'S RANK IN THE TIMBER INDUSTRY.

About three-fifths of Missouri's area was originally covered with timber. The wooded area in 1900 was estimated to be 41,-

000 square miles, or about 60 per cent of the State. Recent investigations indicate that about 27,000 square miles or 39 per cent is at present timbered.

It is to be regretted that there are no reliable estimates as to the total present stand of merchantable timber. My own guess as to the total amount is five billion feet board measure. The amount sawed into lumber can be closely approximated. In 1880, 400 million feet; in 1890, 402 million feet; in 1900, 724 million feet.

Estimating an average cut between census dates, it may be safely estimated that the total lumber production of the State since 1880 has exceeded fourteen billion feet. In 1907, Missouri stood 24th in rank, producing 1.4 per cent of the total lumber cut of the United States, amounting to five hundred and forty million feet, an average yield of 32 feet board measure per acre. *Figuring the present stand at five billion feet, continuing the present rate of consumption, the end will be reached in ten years.* Virtually all of the standing pine timber will have been removed in five years. Admitting the general unreliability of such prognostications, at best it is but a few years until Missouri ceases to be important as a timber producer. On the other hand, her agricultural and other interests increase many fold, thus constantly increasing the demand for wood material. The proper use of the absolute forest soils of the State would prove sufficient for necessary future demands for timber.

FOREST REGIONS.

There are two main topographic divisions of Missouri, commonly called the Ozark and the prairie regions. The northern and western parts of the State are mainly smooth, the southern part mainly rough. In a general way, the line separating these two regions follows the Missouri river from its mouth to the vicinity of Miami, Saline county; thence it runs southward to Windsor, Henry county; and thence southwest to where Spring river crosses the State line in Jasper county. South and east of this line lies the Ozark region, north and west of it the prairie. There may be also included a third division known as the Mississippi bottoms.

The elevation of the country around the foot of the Ozark region is about 800 feet above sea level. The elevation of the top along the central part of the axis varies from 1,400 to 1,700 feet. The central part of the Ozarks is not extremely rugged, though rather high. Around this central part is a region much more rugged where the valleys are deeper and narrower and the whole country cut up with innumerable deep ravines, although the general elevations are not so high as in the central region. To the outside of this belt of rough country, is the border of the Ozarks which is less rugged and slopes down to the prairies and the Mississippi bottoms.

The Ozark region comprises most of the absolute forest land of the State which should be largely devoted to the growth of timber. Although the heaviest timber is in the Mississippi bottoms, in the extreme southeastern portion of the State, it is only a question of a few years until it is removed and the soil reclaimed for agricultural purposes. The remainder of the State is mostly prairie with trees occurring only in groves along the streams. Hence it is the Ozark region which is naturally fitted to be the source of Missouri's future timber supply.

THE MISSISSIPPI BOTTOMS.

In the Mississippi bottoms are dense stands of excellent timber. The cypress, which is one of the oldest and most important trees known, has been largely cut out and there is small chance of her regeneration. Red gum and tupelo are still in abundance but enormous waste has resulted because proper methods only recently have been devised for the handling of these timbers. There is also the rapid-growing cottonwood of large dimensions, giant oaks and numerous trees whose rank and importance may not be questioned. The alluvial soil is deep and rich and if drained, will prove valuable for cotton and other agricultural crops. And yet a large per cent of this land can be profitably devoted to the growing of timber. The red gum and cottonwood, the willow and catalpa, each on its favorite site, finds conditions suited to most prolific growth. So rapidly do these trees develop that successive cuts of merchantable timber may be obtained at intervals of 20 to 30 years perpetually. An improved method of cutting the timber in strips has been devised which permits clean cutting of alternate strips and assures natural reproduction. For large companies the plan will prove eminently successful.

THE OZARKS.

In the Ozarks most of the commercial forest has been cut over. At one time shortleaf pine was the most important tree in the mountains, but its originally limited distribution has been further reduced until it has almost ceased to be an important factor in the lumber production of the State. The oaks—black, white, red, Texan and others—compose the bulk of the forest and have contributed extensively to the manufacture of lumber, ties, posts, cooperage, wagon stock and furniture. The black walnut and white oak have long since been removed, one to furnish gun stocks for our soldiers, the other, oars for our navy. What remains today, of the Ozark forests, is but a sad reminder of what was or might be.

In parts of Arkansas the shortleaf pine reproduces most abundantly. This is not true, however, of Missouri, where pine is followed by black jack oak, post oak, pale leaf hickory and other scrub species. The fires kill the young pines but the more hardy oaks sprout up and form a dense thicket, smothering out the valuable species. In time, the pine may reclaim the land, but it will require centuries for nature to do it unaided by man. There are practicable ways of doing this, but time forbids details. Protection from fire, leaving of seed trees, girdling scrub oaks, and artificial replanting, are means which, under wise direction, will make the rugged Ozark hills pay their tribute to man's enterprise.

FIRE PREVENTION.

The prevention of fires may seem to many neither practicable or desirable, and yet forestry can never be a complete success until adequate fire protection is assured. Fires are very common over much of the Ozark region, being usually started by the farmers to improve the grazing. There is absolutely no doubt remaining in my mind after my experience in the Ozarks, that fires injure and may destroy the large trees, kill seedlings and young trees, and impoverish the soil. Instead of improving the range, they gradually destroy it by robbing the soil and causing a dense growth of hardwood sprouts which choke out nutritious grasses and herbage.

These fires may be largely controlled. I have found by experience that it is not so much regulations against them, as favorable public sentiment for their suppression that minimizes the danger. Adequate laws, backed up by systematic enforcement and accompanied by a campaign of education that will make such law enforcement popular, will solve the problem. Keep down fires and nature herself will restore the forests.

Fire protection is essentially a function of the State. Though the amount of State and Government land is so small, comparatively, that the direct loss from fires falls almost wholly on individuals and lumber companies, yet, owing to the hardwood character of the forest the direct loss is usually considered trifling. The loss in soil productiveness and the prevention of desirable reproduction are more important to the State than to the private individual who owns the land, but has no thought of a second crop. An active campaign of education should be begun and vigorously prosecuted until public sentiment favorable to forestry and forest protection results.

PRAIRIE REGION.

The vast prairie region of the State, embracing as it does much of the finest farming land of America, has also ample room for the practice of forestry. The problem there is concerned mostly with wood lots and small tracts, for the farm is rare indeed that contains no portion chiefly valuable for timber growing. If properly managed the wood lot will supply the farmer with posts, fuel, building material and some timber for market.

Every farmstead should be provided with protection from winds. For the live-stock grower, shielding the barnyard and feedlots will economize the grain necessity to fatten animals, since less food will be required to maintain the body warmth of the stock in winter. In summer, a small part fenced off from the wood lot will afford cool shade to fattening animals, which lose flesh in very hot weather. A belt of forest trees will greatly reduce the danger of late frosts to the fruit blossoms of an orchard.

The woodlot should occupy the waste land not suitable for farm crops. Steep hillsides, ravines, swamps, sand dunes, creek banks, rocky slopes, and corners cut off by ditches, creeks or railroads, will sustain a good growth of timber and become an important source of revenue. Forest growth on steep slopes and river banks protects them from erosion by heavy rains and freshets. On the farm without waste land the woodlot should be so located as to afford the best protection. Strips at least five rods wide should be maintained along the windward side, usually the north and west, and in addition there should be a shelter belt around the house and farm buildings. Such timber tracts add materially to the attractiveness and sale value of the farm.

While this is for the private individual, it remains for the State to assist, direct and encourage his efforts. The details cannot be given here, but the general plan for such assistance would include educative propaganda, experimental and demonstration woodlots and plantations, and expert advice upon request to all who need it.

PRESENT FOREST POLICY.

The forest policy of the State has been wholly destructive. The work of the future should be wholly constructive. One or two large concerns of the State have made some recent attempts to improve their methods with a view to a second crop of timber, but the efforts have been rather spasmodic and aimless. During the year 1906, an investigation of the Ozark region was made under my direction by the Forest Service, U. S. Department of Agriculture, in co-operation with the Missouri State Experiment Station. Some good data was secured as a basis for future activities but the funds were too limited to permit of an exhaustive study. I am informed that Governor Folk has appointed a Forestry Commission consisting of Dr. W. H. Black of Marshall, Dr. Hermann von Schrenc of St. Louis and Mr. David A. Latshaw of Kansas City. I am not familiar with the plans or scope of this commission.

Considerable interest throughout the State has been recently manifested in the forestry movement. Part of this is due to the general awakening over the country to the necessity for conserving our natural resources. Special credit is due the University of Missouri and to the Missouri Federation of Women's Clubs. The time is opportune for a definite constructive forest policy.

A PROPOSED POLICY.

Assuming that the advantages and necessity for forest conservation and extension are clearly evident, the important question arises as to proper means to the end. It is characteristic of the American people to be long suffering until, as it were, the limit of elasticity is reached when we suddenly undertake to change the work of decades by summary legislation. In such times, there is danger of going to extremes and of following ill advisers.

My advice to the people of Missouri on the forestry question is to begin at once, but proceed slowly. The methods of a century cannot be revolutionized in a day and it cannot be expected that a people who for years have been busy destroying the forests, should suddenly concern themselves with forest protection and tree planting. This change must come gradually, but because of the slowness of the movement, there is all the greater reason for immediate action.

My report of 1906, covering my investigations of Missouri's resources, contains this recommendation which received the approval of the United States Forester: "To devise and direct a permanent policy along the lines suggested, the establishment of a regular course in forestry at the University of Missouri is recommended. The instructor in charge of this department should be a technically trained forester who, besides his regular duties of instruction, should have charge of the forestry work of the State. It should be his duty to assist land owners in establishing plantations, to aid timber owners in the conservative management of their lands, to lecture at farmers' institutes and other public meetings, and to publish and distribute reports concerning State forest problems and their solution. During the summer months he could conduct field work, employing his forestry students as assistants. This same plan is now being successfully carried out in making a soil survey of the State. It is believed that better results can be secured in this way at first and at less expense than by the establishment of a salaried forest commission."

The two years which have elapsed since that report, have served to more firmly convince me of the wisdom of that recommendation. Since education in forestry is now most needed to prepare the people of your State for an impending timber famine, where better can the start be made than at your State University? Thousands of students pass its portals to take their place in the progress of the nation. Each will become in some degree a leader in his community and play no small part in the molding and direction of public sentiment. How important it becomes that these men and women, whether farmers or physicians, lawyers or teachers, should carry with them an adequate knowledge of the principles of forestry, to be able in the impending crisis to choose the true from the false, the practicable from the visionary, the sensible from the sentimental.

Let the instructor be chosen because of his ability and knowlledge of his profession, untainted by political patronage. Give him time and means to organize his department, conduct experiments on the college lands, extend his investigations to the entire State, devote a large share of attention to the aid of farmers and timber owners, and in a very few years he will have laid the sure foundations for a practicable and sane forest policy for the State—quietly, systematically, and economically.

THE ONTARIO AGRICULTURAL AND EXPERIMENTAL UNION.

(Prof. C. A. Zavitz, Ontario Agricultural College.)

I will speak to you on the work which we have been carrying on in the Province of Ontario during the past few years. I assure you that it is a pleasure to me to meet you who are here in connection with this great institution, you who are connected with the agriculture of this state—to meet you here in convention. I always feel very much at home when I meet those who are endeavoring to advance agriculture, whether found in homes throughout the country, or in connection with an institution of this kind. I have been connected with an institution somewhat similar to this during the past twenty-four years. I went from one of the farms of Ontario to our own Agricultural College in 1884. I became connected with the work there some two or three years afterwards, and from that time to this I have been trying to do something in connection with the advance of agricultural education and the improvement of the homes throughout the Province of Ontario, and I think possibly some things have been done which have had an ennobling influence not only upon the farms but also upon those who are connected with the farms. We have an Agricultural College, started in the year 1884. The experimental work of that institution was started just two years later, in 1886. At that time, we started work in the field in our plots with the object of trying to find out some of the best varieties of farm crops, best methods of cultivation, selection of seed, etc., in a small way. The first year we had some fifty-six plots altogether. That number increased from year to year until we have now about 2,000 plots, field plots, where we are experimenting on different varieties year after year, the results of which experiments we are hoping will be of real value to the farmers who are engaged in farm work throughout the Province of Ontario. After this work had been going on for about ten years—the value of which should be of great service to the farmers, (we sent this information through our reports and bulletins and newspaper articles to them) we thought that there was great room for co-operative experiments. Therefore, we started, some twenty years ago, a small system of co-operative experimental work through what is known as the Ontario Agricultural and Experimental Union. I wish to say a few words in regard to that organization. It was started in 1879 by the ex-students of our College, who felt that they wished to get back to the institution once a year to meet their associates, to come in touch with the institution, with their alma mater, and to keep abreast of the times from an agricultural standpoint. After this work had been going on in this way for a few years, we felt that it would be an association through which we could carry on our co-operative and experimental work throughout the province. Therefore, in 1886, we started, with this association of ex-students, a small system of co-operative experiments. The first year they were twelve in number. We wrote to the ex-students and obtained the consent of twelve of the number to conduct experiments upon their own farms. From those twelve experiments, we obtained eight reports. The next year we secured sixty experimenters, the next year ninety-three, and the work has gone on from year to year until we now have 4,420 farmers who are conducting experiments upon their own farms, in connection with our work at the College, with farm crops. Then we have about 3,000 men carrying on experiments with horticulture, some in poultry-raising, and quite a large number in forestry. We have altogether work being carried on now along some six or seven different lines, and that work has all had a very wholesome influence. It not only keeps the ex-students in touch with the institution, but it also enables the College to place a piece of the Experiment Station in homes all over Ontario; it enables the farmers to conduct experiments on their own farms; it gives the farmers something to think and study about, in a way not thought of before. Therefore, I say that it not only has an influence in keeping the ex-students in touch, but it encourages the farmers to increase the profits of the farm, it introduces upon their farms a number of the best varieties of crops, and shows them improved methods of cultivation.

Then, it has a very wholesome influence in the advancement of agriculture throughout the province. I do not know of anything which has had a greater influence in elevating the people, enabling them to think for themselves, than this work. We see the results of our work now all over the province. We find that by sending out improved varieties, showing better methods of cultivation, through the influence of that work, and through the influence of our other experimental work, that the output of the Ontario farms, during the past fifteen years, has been *doubled,* which is a statement, I think, which means a great deal. The output of Ontario farms has actually been doubled in about fifteen years. We find that it has created great interest all over the province; it has filled our College of Agriculture to overflowing. We had 1,000 students last year connected with the College. During the summer, we have in the month of June from thirty to thirty-five thousand farmers visit our experimental grounds—two hundred to three thousand every day from the 5th to the end of June. I am stating actual facts, and not saying this boastfully. They are interested in this work because they are conducting experiments on their own farms and they want to see the same experiments carried on on a larger scale. They come in groups of five and six and seven hundred. We take them out into the fields. We ask and answer questions, we keep moving over the experimental fields, talking about the different experiments, and after they have spent a full day, they return to their homes at night.

I believe that you have here an organization of the ex-students of this institution. If you could work through that organization, and through the experiment station, you can bring about results of this kind throughout the state, and I believe you would find that it would pay and pay well and have a very wholesome influence. When we started in the work, we did not know how it would turn out; but we kept up the work until now we have between seven and eight thousand experimenters altogether. It is having a wonderful influence all over the Province of Ontario, not only giving us increased yields per acre, but also increasing the interest in agriculture, creating a greater love for agriculture and a higher education, and a greater development of the profession.

Missouri Corn Growers' Session.

Friday, January 8, 1909.

THE IMPROVEMENT OF CORN BY BREEDING.

(By Dr. Louie H. Smith, Assistant Chief in Plant Breeding, University of Illinois.)
Illustrated with Stereopticon.

FUNDAMENTAL PRINCIPLE OF BREEDING.

In plants, as well as in animals, improvement by breeding depends upon selection and selection in turn depends upon variation. In our ordinary field crops we have been so accustomed to consider the crop as a whole that we are apt to overlook the individuality of the plants that make up the crop and the great variations that exist among them. Go into any field of corn and observe the differences in the various characteristics; there are plants with tall stalks, short stalks, abundant foliage, scant foliage, erect ears, declining ears, productive and unproductive, growing side by side, all under apparently the same life conditions. Every single plant is possessed of a distinct individuality, just the same as every animal, and the transmission of the

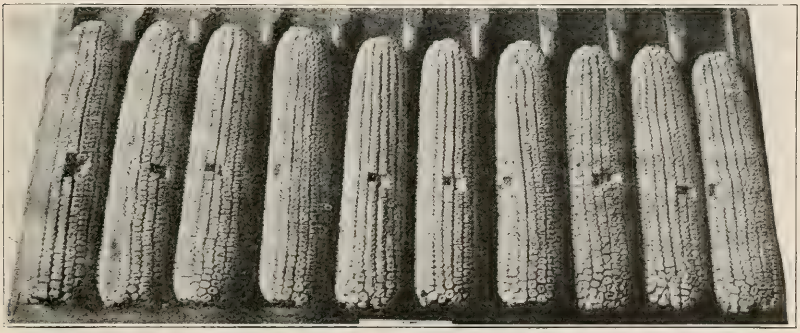


Figure 1. Champion ten ears corn, 1908, National Corn Exposition, Omaha Neb.

characters which go to make up this individuality in plants is just as certain and definite as it is in animals. In selection we simply pick out those individuals having the desirable characteristics and propagate them to the exclusion of others.

VARIATIONS IN PRODUCTIVENESS.

There are great variations in productiveness as well as in other characteristics and this is particularly noticeable among

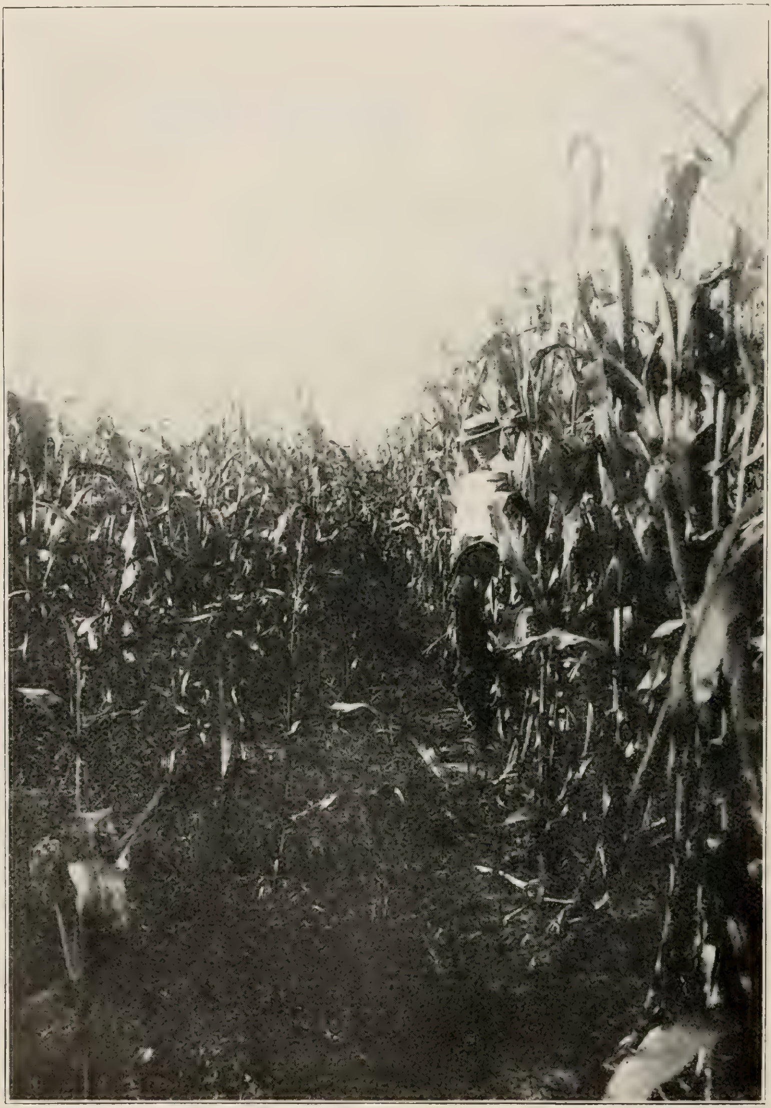


Figure 2.—Row No. 12 and row No. 13 of the breeding plot, each row planted from a certain seed ear.

the different ears of corn. Take a number of equally good appearing ears, if you please, like those splendid specimens, the ten champion ears of the recent National Corn Exposition, illustrated in figure 1; such ears as satisfy all our notions of perfection in corn, including proper proportion of length to circumference, size, form, shape of kernels, proportion of grain to cob and so on through the ordinary score-card points; put these ears to a performance test in the field, make them show up their yielding qualities, and it may be that you will find that some ears out-yield the others by two to one. There is no way of discovering this difference in productiveness from the appearance. We must put them to the actual test in the field—such a test as is given in the "ear-to-the-row" breeding plot.

Extreme variations of this sort are not uncommon in our breeding plots, but an instance occurred a number of years ago which was especially interesting from the fact that a good ear and a poor ear happened to be planted side by side in adjoining rows, thus making the comparison especially striking. Figure 2 shows the condition of the two rows planted from these two ears as they grew in the field, and figure 3 tells us the result of the harvest of these same two rows. There was nothing in the appearance of the seed ears to indicate that row 13 would produce more than twice as much as row 12.

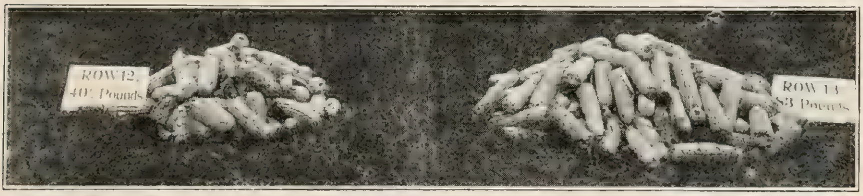


Figure 3.—Row No. 12 and row No. 13 at the harvest time.

EFFECT OF SELECTION UPON CHEMICAL CHARACTERS OF THE GRAIN.

Corn improvement should embrace quality as well as quantity. No other crop is made to serve such a variety of purposes as corn, and in consideration of these many different uses is suggested the question of special adaptation.

Purpose of Increasing the Protein.—In the nutrition of man and beast, protein is the most expensive nutrient. Of all our American food-stuffs corn is the cheapest, because of its economical production. But because corn does not contain sufficient protein for most purposes of feeding, it must be reinforced by other more expensive food-stuffs in order to obtain the proper ratio of this important nutrient. It is from these considerations that farmers, and especially stock feeders, recognize the importance of breeding corn for increase of protein content.

Purpose of Decreasing the Protein.—On the other hand, there is a demand from the manufacturers of those products which are derived from the starch of corn, such as glucose, gum, dextrine, syrup, and alcohol, for a corn having a large proportion of carbohydrates and not so rich in protein. The practical effect of decreasing the per cent of protein is to increase the per cent of starch; therefore, for such purposes there should be a place on the market for corn which is bred for decrease of protein content.

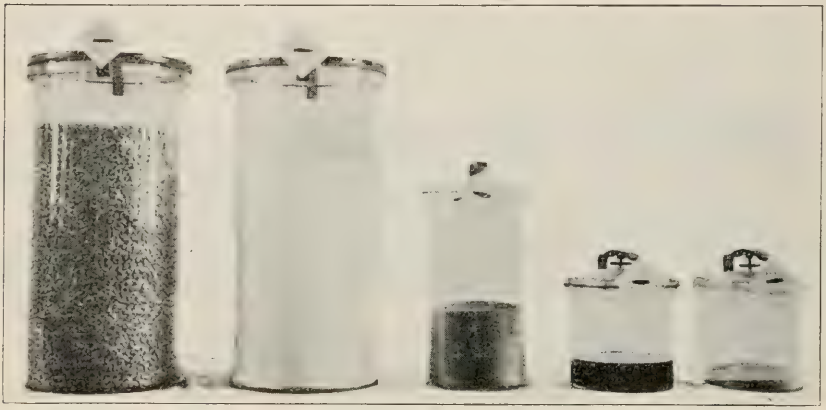


Figure 4.—Composition of one bushel of ordinary corn. In the photograph the crude fibre is missing, amounting to 1½ pounds.

Purpose of Increasing the Oil.—The oil of corn has in recent years found such a wide commercial use that under the present market conditions, it has become, pound for pound, by far the most valuable constituent of the grain, and, whereas, formerly in the glucose factories and corn mills the germs containing the oil were almost a waste product, there is now an actual demand on the part of these industries for corn which is richer in oil. It is proposed to meet this demand by breeding corn for increase of oil content.

Purpose of Decreasing the Oil.—There is also a practical use for corn with a low oil content. It has been found by investigation that in feeding swine, the oil in the corn tends to produce a soft, flabby quality of flesh, which is very undesirable, especially for our export trade, where the demand of the market is for a hard, firm product. A remedy for this lies in the reduction of the oil content of the corn which is fed. Thus here we have a very important practical object for breeding corn for decrease of oil content.

These special purposes mentioned for which corn is being improved suggest the possibility of many others demanded by the various industries which utilize the corn crop and which require different qualities in it.

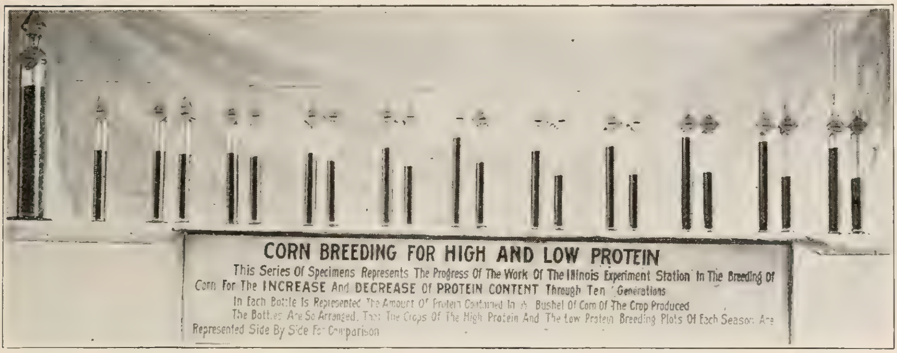

CORN BREEDING FOR HIGH AND LOW PROTEIN
This Series Of Specimens Represents The Progress Of The Work Of The Illinois Experiment Station In The Breeding Of Corn For The INCREASE And DECREASE Of PROTEIN CONTENT Through Ten Generations
In Each Bottle Is Represented The Amount Of Protein Contained In A Bushel Of Corn Of The Crop Produced
The Bottles Are So Arranged That The Crops Of The High Protein And The Low Protein Breeding Plots Of Each Season Are Represented Side By Side For Comparison

Figure 5.

The average composition of ordinary corn is shown in figure 4, where are represented the different constituents and their relative amounts in one bushel of the grain.

It is possible by selection of the seed and breeding to alter the proportions of these various constituents, and following are indicated briefly some of the results which have been obtained in breeding corn to change its composition.

The effect of breeding for increase and decrease of protein content is illustrated in figure 5. In this case we have our quantities based upon one-tenth bushel and in the large bottle there is one-tenth bushel of corn. The amount of protein in this quantity of corn is so represented that we may compare the high protein crop with the low protein crop of each generation. Beginning on the left with the crop of 1896, and following it along through the ten generations, we find comparatively little difference in the first two or three years. It seems to require a few years to get under good headway but as we follow along the series we find that the difference between the high and the low gradually increases until after ten generations the high strain contains almost double the amount of protein as the low strain.

In order to show these results in somewhat more detail, the following table is given:

INCREASE AND DECREASE OF PROTEIN.

Year.	High protein plot, average percent in crop harvested.	Low protein plot, average percent in crop harvested.	Difference between crops, percent.
1896	10.92	10.02	0.00
1897	11.10	10.55	0.55
1898	11.05	10.55	0.50
1899	11.46	9.86	1.60
1900	12.32	9.34	2.98
1901	14.12	10.04	4.08
1902	12.34	8.22	4.12
1903	13.04	8.62	4.42
1904	15.03	9.27	5.76
1905	14.72	8.57	6.15
1906	14.26	8.64	5.62
1907	13.89	7.32	6.57

A glance through these figures shows that it has been possible in eleven generations to increase the protein content from 10.92 per cent to 13.89 per cent, and at the same time, by breeding for low protein, it has been possible to reduce this constituent from the original average of 10.92 to 7.36 per cent. In other words, starting with a single variety, we have been able by ten years of breeding to produce two kinds of corn, the one of which is almost twice as rich in feeding value as the other.

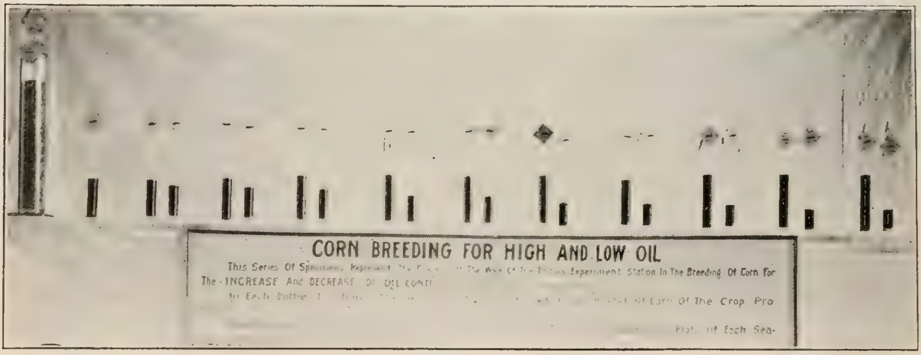

CORN BREEDING FOR HIGH AND LOW OIL
This Series Of Specimens ... Experiment Station In The Breeding Of Corn For
The INCREASE And DECREASE Of OIL CONT
In Each Bottle ... Of Corn Of The Crop Pro
Plot, of Each Sea-

Figure 6.

Even more striking have been the results accomplished in the breeding to influence the oil content as illustrated graphically in figure 6 and numerically in the table following.

Starting on the left, the amount of oil is shown in the crop of

1896 with 4.7 per cent, and following along through the series we notice how the oil increases or decreases in response to the selection, and how the difference between the two strains is constantly widening until finally after ten generations we have in the crop of 1906 about three times as much oil in a bushel of high oil corn as in the low oil strain. That is to say, by selection and breeding we have produced from a single variety of corn two kinds, the one of which is about three times as rich in oil as the other:

INCREASE AND DECREASE OF OIL.

Year.	High oil plot, av. percent in crop harvested.	Low oil plot, av. percent in crop harvested.	Difference between crops, percent.
1896	4.70	4.70	0.00
1897	4.73	4.06	0.67
1898	5.15	3.99	1.16
1899	5.64	3.82	1.82
1900	6.12	3.57	2.55
1901	6.09	3.43	2.66
1902	6.41	3.02	3.39
1903	6.50	2.97	3.53
1904	6.97	2.89	4.08
1905	7.29	2.58	4.71
1906	7.37	2.66	4.71
1907	7.43	2.59	4.84

EFFECT ON TYPE OF KERNEL.

That selection for certain chemical constituents has a very noticeable effect upon the physical characteristics of the kernel was observed quite early in this work.

Selection for high protein has developed a type of kernel having a relatively larger proportion of that part characterized by its horny structure the soft starchy part which surrounds the germ and runs up into the crown of the kernel being less prominent. In the type of kernel resulting from the low protein selection this condition is reversed and here the soft starchy part predominated. Viewed externally the high-protein kernel has a somewhat glassy appearance while the low-protein presents a milky effect. Figures 7 and 8 which are diagramatic representations of a high-protein and a low-protein kernel respectively illustrate very well this distinction. In photograph 9 the kernels on the left were taken from an ear analyzing 14.92 per cent of protein while those on the right are from an ear which contained only about one-half as much, namely, 7.76 per cent.

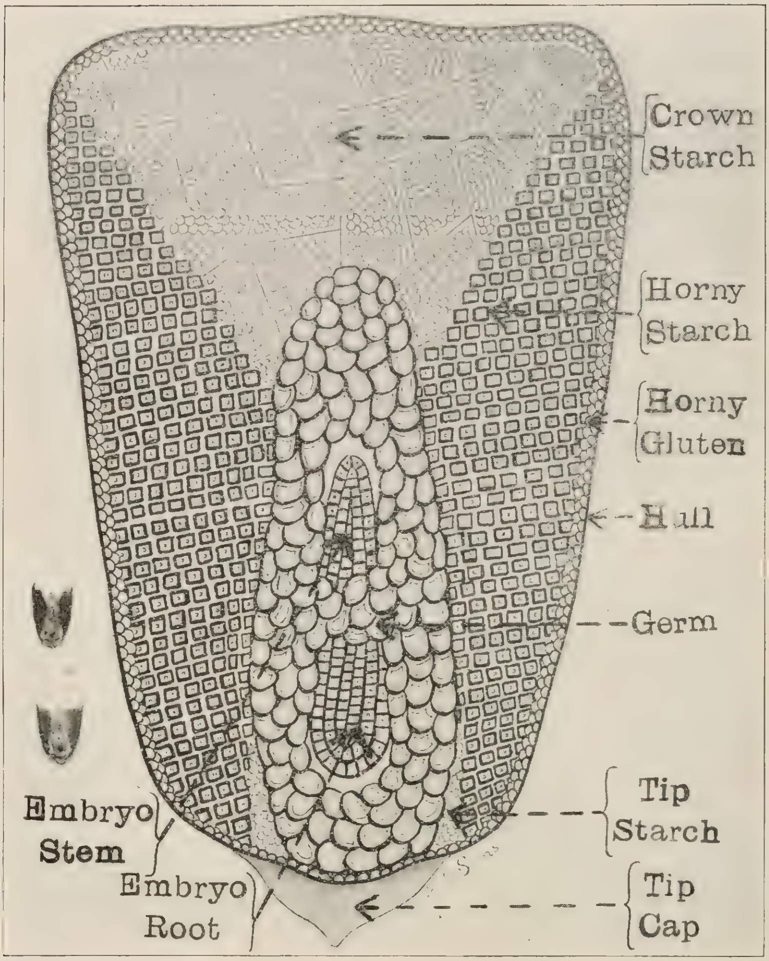

Crown Starch
Horny Starch
Horny Gluten
Hull
Germ
Embryo Stem
Tip Starch
Embryo Root
Tip Cap

Figure 7.—Diagram illustrating structure of High-protein kernel.

Following the fact that about four-fifths of all the oil in the kernel resides within the germ, the selection for high-oil has resulted in a kernel having a relatively large proportion of germ, while the low-oil selection has produced a kernel whose germ occupies a relatively small proportion of its bulk. These relations are brought in figure 10, which represents kernels from high-oil and low-oil ears, on the left from a high-oil ear testing 6.08 per cent; on the right from a low-oil ear containing but 3.64 per cent of oil.

EFFECT OF SELECTION UPON PHYSICAL CHARACTERS OF THE PLANT.

Other interesting examples of what may be accomplished by continued selection for particular purposes are furnished by a number of experiments designed to influence certain physical characters of the plant.

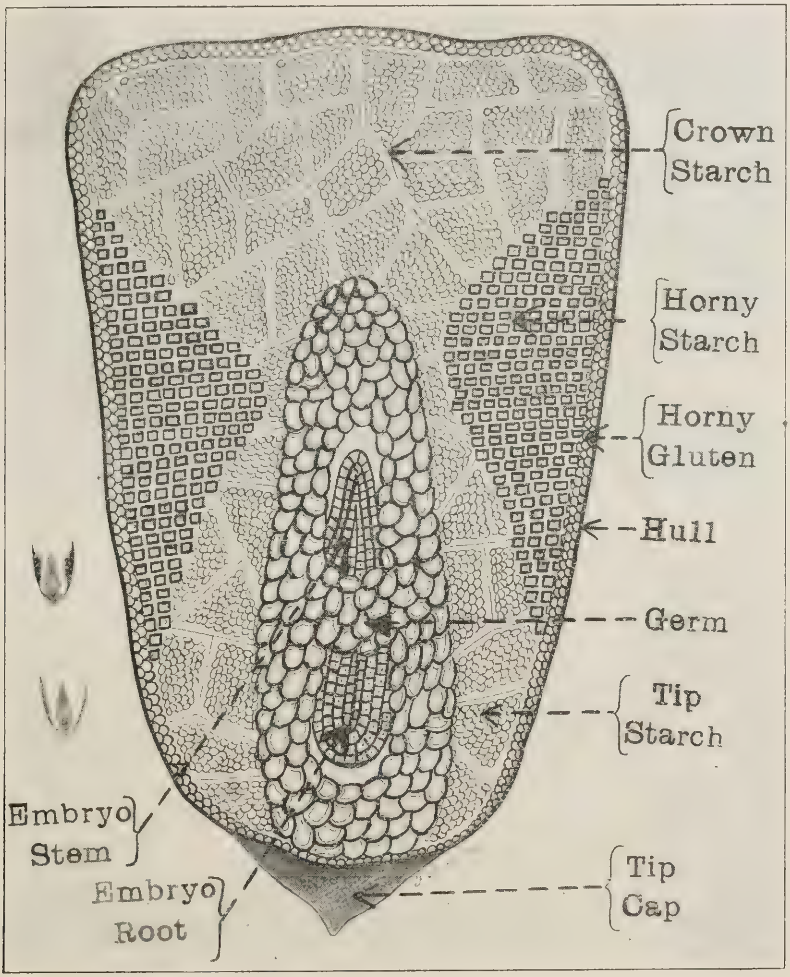

Crown Starch
Horny Starch
Horny Gluten
Hull
Germ
Tip Starch
Embryo Stem
Embryo Root
Tip Cap

Figure 8.—Diagram illustrating structure of low-protein kernel.

BREEDING FOR HIGH AND LOW EARS.

Six years ago from an ordinary field of Leaming corn two sets of ears were selected, one of which represented ears growing high on the stalk, and the other those borne low down on the stalk. These two sets of ears were planted in separate breeding plots

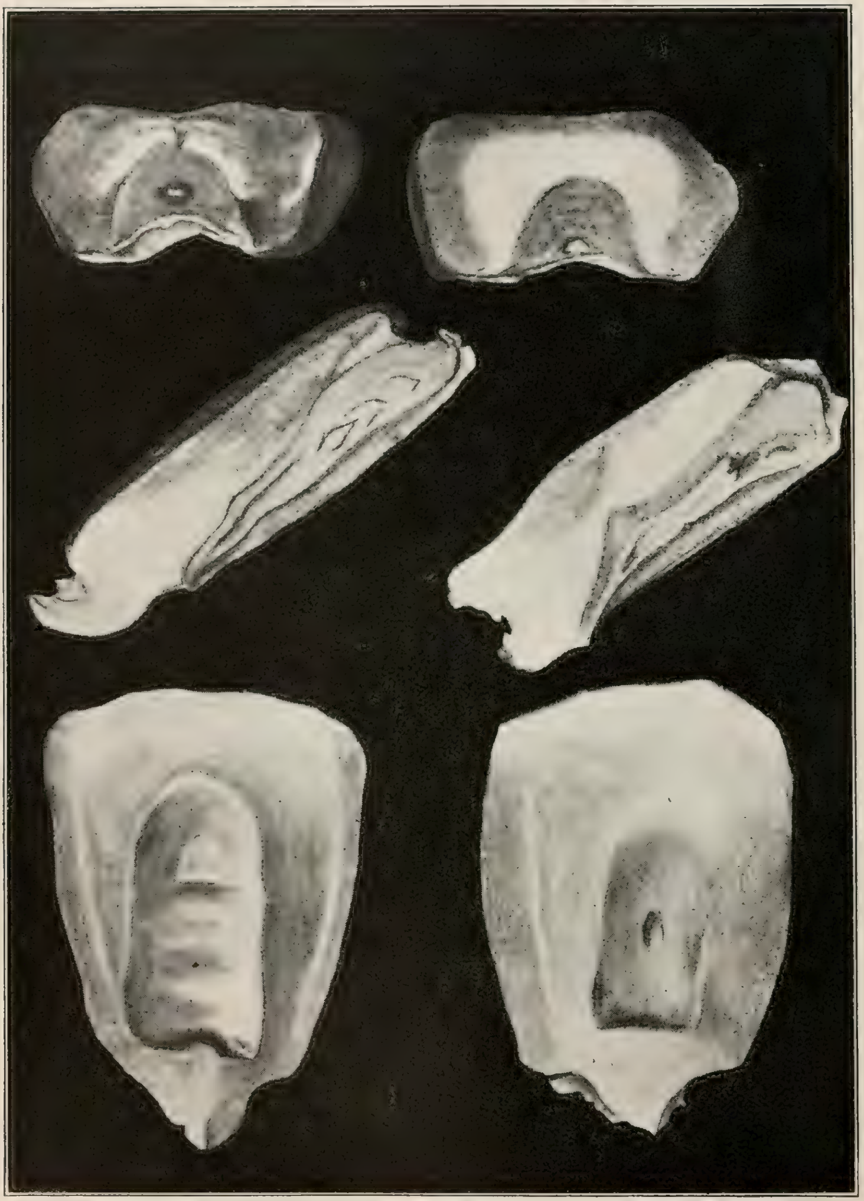


Figure 9. High-protein and low protein kernels.

and selection for high ears and for low ears from the respective plots have been made each year since.

The first year there was produced a difference in average height of ear between the two plots of over thirteen inches. This average difference has increased until after six generations of

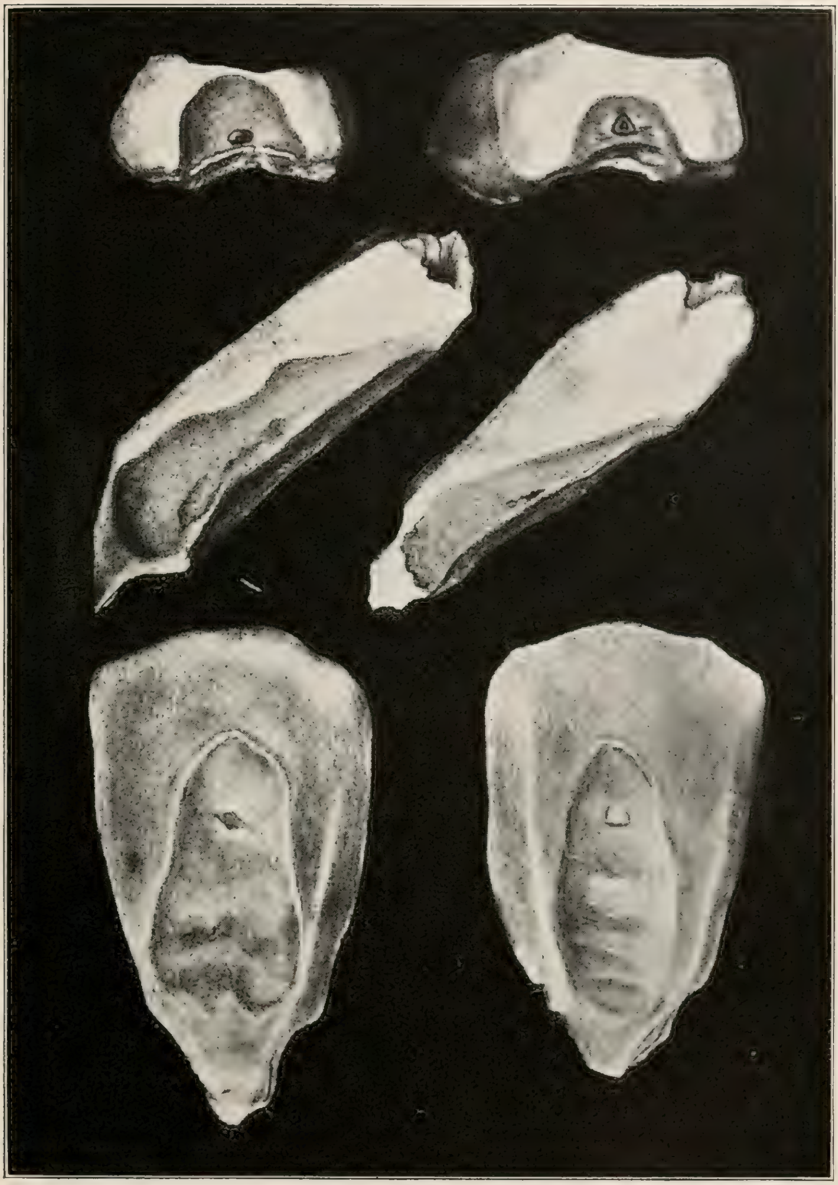


Figure 10. High oil and low-oil kernels.

breeding the ears in one strain are borne, on the average, about three feet higher than in the other, as an inspection of the following table will show:

BREEDING FOR HIGH AND LOW EARS.

AVERAGE HEIGHT OF EARS IN INCHES.

Year.	High ear plot.	Low ear plot.	Difference.
1903	56.4	42.8	13.6
1904	50.3	38.3	12.0
1905	63.3	41.6	21.7
1906	56.6	25.5	31.1
1907	72.4	33.2	39.2
1908	57.3	23.1	34.2

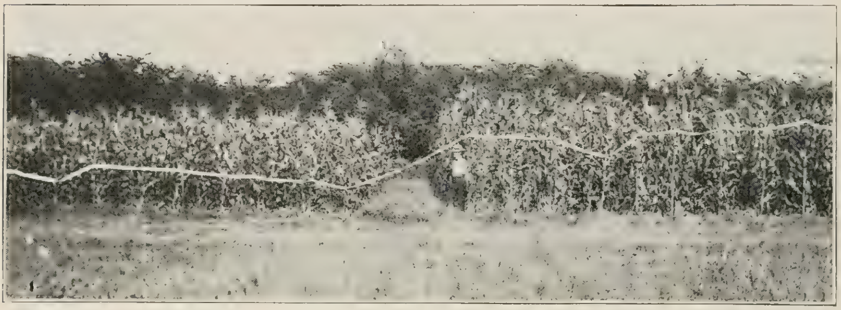


Figure 11.—High-ear and low-ear breeding plots in the fifth generation.

Figure 11 shows the two plots in the fifth generation. The white tape shown in the picture was fastened at the middle of the ears in the front row.

Photographs 12 and 13 were taken the same day and they give a closer view of these two plots.

It will be noticed that a remarkable difference in the size of the plant has been induced by selecting simply with reference to height of ear. With this difference in size of plant there is a notable difference in time of maturity between these two strains so that at the time of tasseling the low-ear plot is now about a week in advance of the high-ear plot.

It is of especial interest to note that in spite of the much smaller size of the low-ear plant, in production of grain this strain is thus far yielding fully as well as the high-ear strain. This is very significant, for one of the most important questions before the attention of the corn growers and corn breeders today is that of maturity. The demand is for grain that will grade better in the market, keep better in storage, ship better in exportation, germinate better when planted, and our problem is the difficult one of inducing earliness without sacrificing yield.

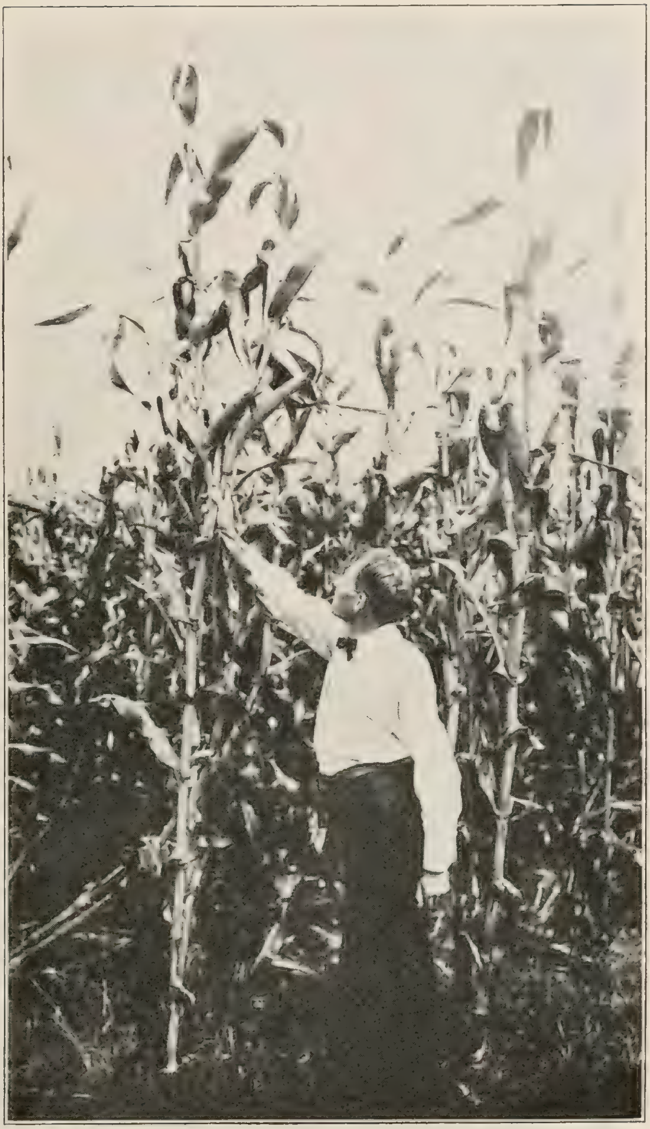


Figure 12.—In the high-ear breeding plot in the fifth generation.

Some of our leading corn growers are advocating a reduction in the standard size of ear in the belief that a longer growing season is necessary for the production of the large type of ear that has been set for the ideal, and that striving to attain this ideal has resulted in lateness in maturity of some of our best varieties. This is to some extent plausible; but it would seem that the lesson brought out by these experiments is that attention should be given to size of plant as well as to size of ear and that by selecting well-developed ears borne comparatively low on the stalk of smaller plants we shall accomplish more in inducing earliness at possibly less sacrifice in yield than in attempting to regulate the size of ear alone.

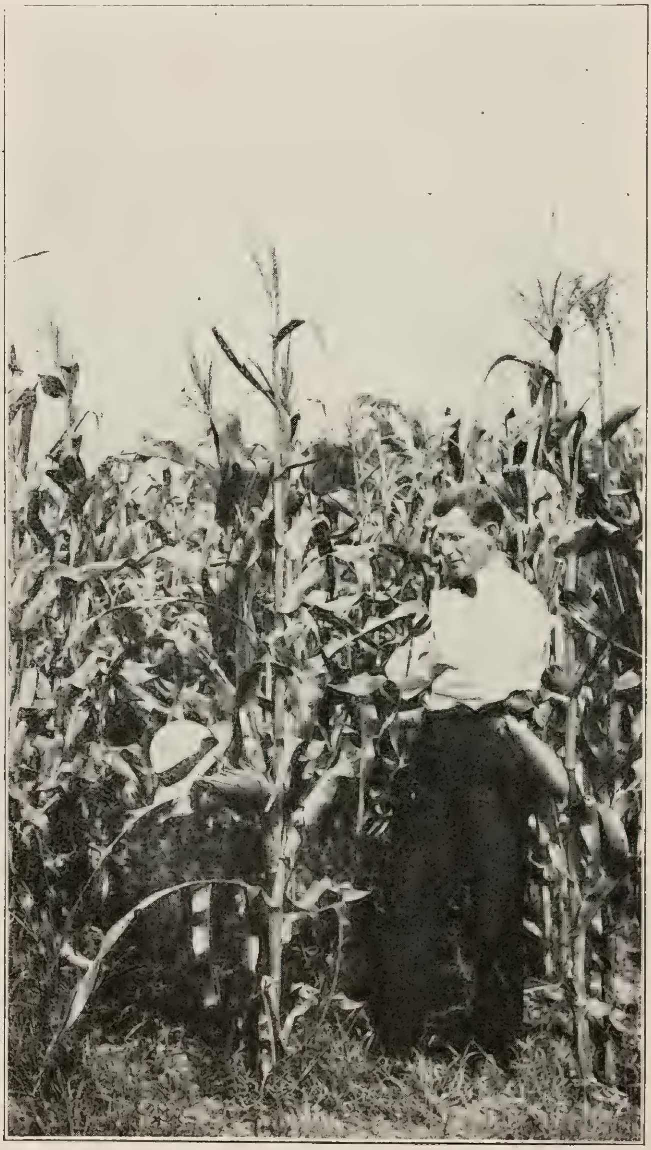


Figure 13.—In th low-ear breeding plot in the fifth generation.

BREEDING FOR ERECT AND DECLINING EARS.

Among the very noticeable variable characters to be seen in any field of mature corn is the manner in which the ear is borne with reference to the angle which it makes with the stalk. A few minutes observation will discover all degrees of declination of ears, varying from those which stand almost perfectly upright to those that hang straight downward.

It has been found by experiments covering five generations of breeding that the angle of declination of the ear is also a character

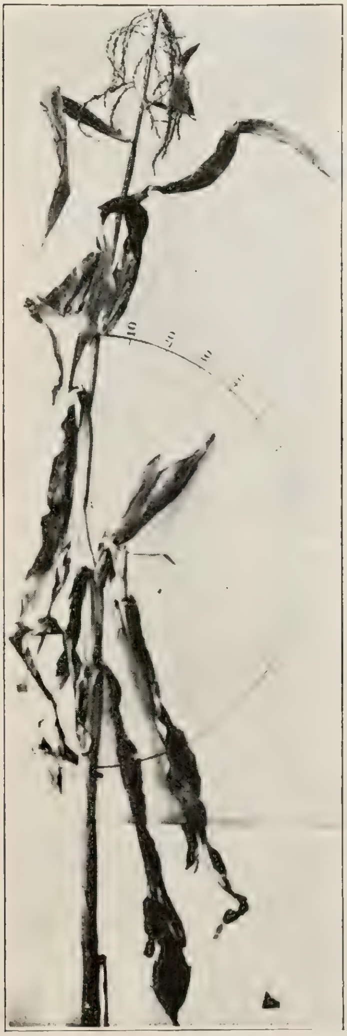


Figure 14.—The average angle of declination in the erect-ear strain in the fifth generation is 46 degrees.

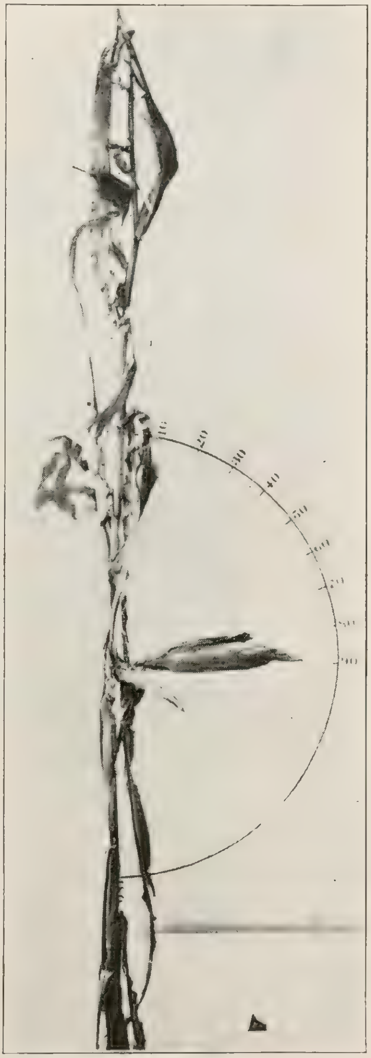


Figure 15.—The average angle of declination in the declining-ear strain in the fifth generation is 88½ degrees.

that can be modified by selection. The summarized data of these experiments is given in the following table:

AVERAGE ANGLE OF DECLINATION FROM THE STALK.

Year.	Erect Ears crop.	Declining Ears crop.	Difference between crops.
1904	42.0°	45.°	3.0°
1905	62.2°	117.1°	54.9°
1906	49.5°	76.2°	26.7°
1907	42.3°	81.6°	39.3°
1908	46.0°	88.5°	42.5°

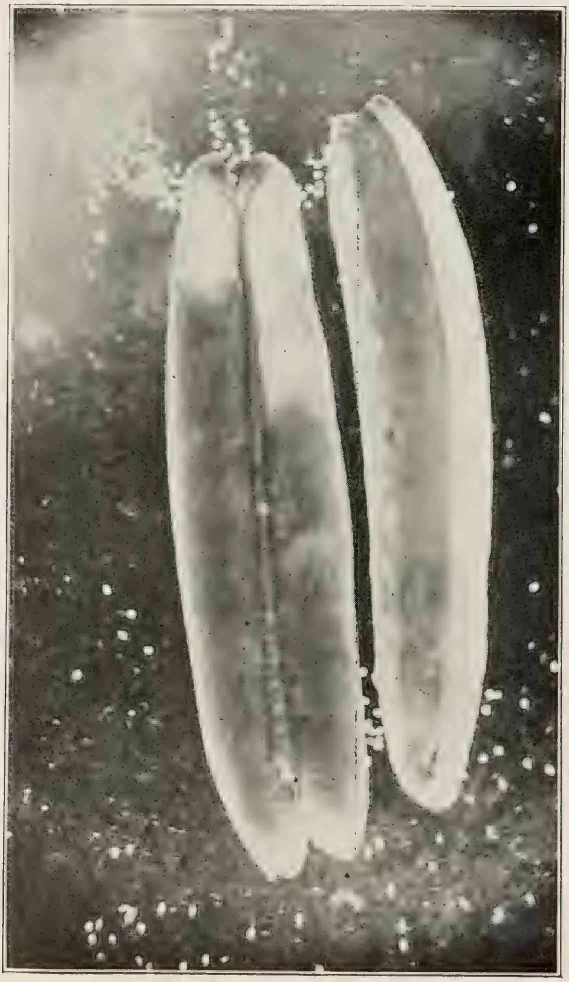


Figure 16.—Ripe anthers bursting open and pollen grains escaping. (Greatly magnified.)

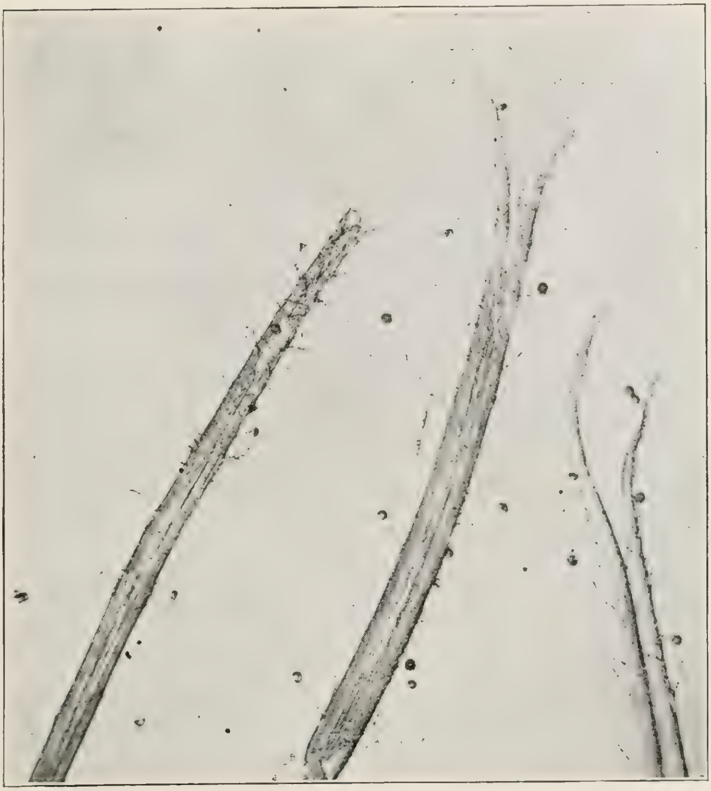


Figure 17.—Pistils (silks) with pollen grains adhering.

It will be noticed that in the first generation the response to the selection was very slight as indicated by the results in the last column, where the figures show the average difference each year between the two plots. In the second year this response was very much greater, in fact the results show that it was more marked that year than it has been since. The conditions of that season seem to have been exceptionally favorable for declining ears as seen from the results in both plots. After the second year the average difference in the crops has steadily increased. On the whole, we find that we have been able to influence this character to a considerable extent in the five years of breeding; and, with the exception of 1905, it has responded almost as faithfully and regularly to selection as in the case of the height of ear.

Figures 14 and 15 represent the average angle of declination in each strain after five generations, and a comparison of the two pictures shows at a glance what has thus far been accomplished in this line of selection.

No significant effect from this selection is yet apparent upon the yielding capacity. From the practical standpoint the thing desired is the declining ear, the advantage being found in the better protection from rain and the greater convenience in handling at harvest.

THE FLORAL ORGANS.

All of this work in the breeding of corn is beset with extra complications because of the fact that corn belongs to that class of plants which is said to be "open-fertilized," as distinguished from "self-fertilized."

The next two pictures represent the floral organs of the corn plant. The tassel is made up of the male flowers of which the essential organs are the anthers which produce the pollen. Figure 16 shows a pair of such anthers highly magnified in the ripe condition. The anthers have just bursted and the pollen grains are seen escaping.

HAND
POLLINATED
IN-BRED

Figure 18.—Planted from in-bred seed.

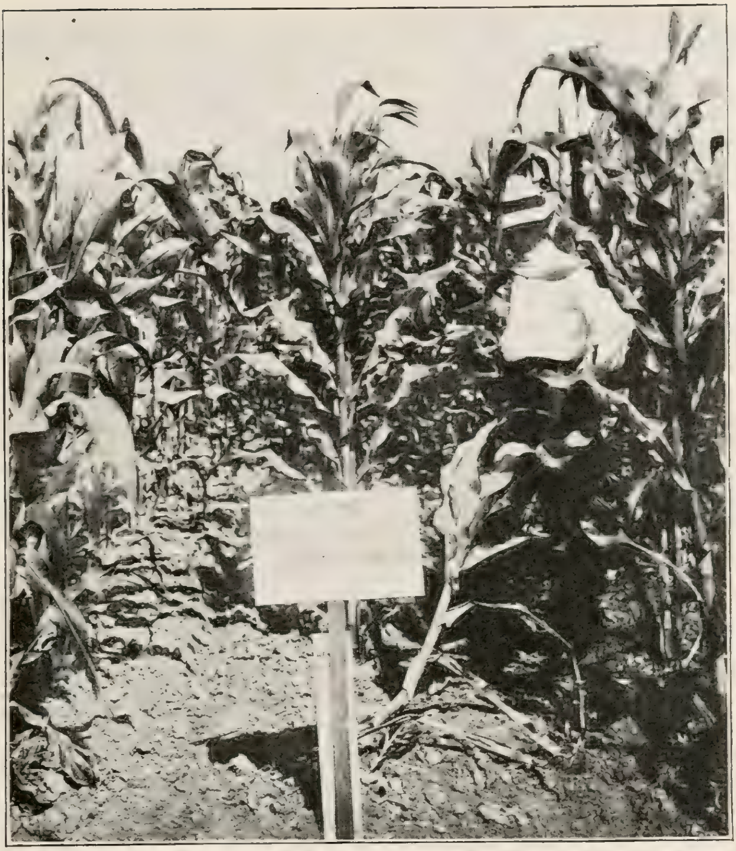


Figure 19.—Planted from cross-bred seed.

The female flowers are situated in the ear and the development of the kernel results from the fertilization by the pollen coming in contact with the silks as shown in figure 17. In this process the pollen grain germinates, throwing out a little tube which finds its way down the length of the silk and finally comes in contact with the reproduction cell of the kernel. There then follows the fusion of a tiny quantity of substance from this cell and from the pollen cell, and as a result of this fusion the kernel develops. If, for any reason, this fertilization process does not take place, the kernel does not develop.

EFFECT OF IN-BREEDING.

As stated above, corn is by nature a cross-fertilized plant and in-breeding appears to have a decidedly detrimental effect upon the yield and vigor. In the breeding plot where the plot is all planted from closely related ears we have conditions for more or less close-breeding.

A comparison of figures 18 and 19 demonstrates this detrimental effect of in-breeding. The plot shown in figure 18 is planted from seed which has been continuously inbred for five generations, while that shown in figure 19 is planted from seed of the same origin, but which has been continuously cross-bred during this same time. These two plots are otherwise under the same conditions, planted the same day on similar soil, cared for alike and photographed the same day.

CONCLUSION.

I have tried to present in outline a few of the experiments which illustrate the principles involved in the breeding of corn, and with the hope that they may suggest something of the possibilities for the improvement of this all-important crop by the method of continuous selection for definite purposes.

SIMPLE METHODS OF SEED IMPROVEMENT.

(By H. J. Webber, Professor of Experimental Plant-Breeding, Cornell University.)

The speaker's reason for selecting this subject for discussion is based on the observations he has made in various parts of the country. He finds that while great advance has been made in devising improved methods for the breeding of our important crops the great mass of the people remain as yet indifferent to the importance of the subject. The conclusion to be drawn from this indifference must primarily be due, he thinks, to the fact that the methods usually advocated are so complex that farmers generally consider them to be impractical for ordinary use. Indeed, this we can but admit is true in the case of general farmers. It seems to the speaker that what is most desired at the present time is the general use by all farmers of some systematic improved method of seed selection which will be only slightly more complex than the methods they now use. It is with this in view that the following simple methods of selecting seed for potatoes and corn are proposed.

SELECTION OF SEED POTATOES.

So far as the speaker's experience goes few farmers are giving attention to the selection of their seed in the case of potatoes, and yet experiments which have been carried out here and there over the country show very clearly that striking improvements can be made by the simple selection of seed from the best yielding hills. Here we have the opportunity of using very simple methods of seed selection which, if put into operation generally, would probably increase the crop nearly one-fourth, and yet scarcely any farmer is giving this matter any attention. The following method, the speaker believes, is applicable for general use, and he believes that we can conscientiously urge it upon every farmer as an important practical method.

SELECTION OF SEED TUBERS.

Probably every farmer knows a good seed tuber, although we are frequently inclined to look upon the largest tuber as the best. This is clearly an error, as too large a tuber is almost as bad as too small a tuber. Probably the best sized potato for general use is one weighing from seven to eight ounces. A potato of this size does not have to be cut when served, as a single tuber is about the right size to serve to an individual. Again, this sized tuber is well fitted for cooking as it is small enough so that the interior will cook nearly as quickly as the exterior.

It is important that the tuber should have a certain shape as well as a certain size. Probably the most desirable shape is one where the tuber has a major axis, or length of about three and one-half to four inches, with a width of possibly three to three and one-quarter inches and a thickness of from two to two and one-quarter inches. In a tuber of this shape the center of the potato at any point is only about one inch from the exterior. If potatoes are round and thick the exterior becomes well cooked before the interior is thoroughly done, and if they are mealy, as is desired by Americans generally, the exterior is liable to fall apart and cause waste by the time the center is thoroughly cooked.

In starting the selection the speaker would advocate that every farmer select tubers for planting of as nearly the ideal shape and size as can be obtained by going over a large part of his crop. He should give special attention to getting correct shape, size, shallowness of eyes, etc. These tubers should then be properly preserved, a point which will be emphasized later, and should be planted in a special part of the field the next season; planting as nearly as possible pieces of uniform size. The seed tubers, if properly selected, all of about uniform size, can be cut into quarters, and these pieces will be nearly enough of the same size to answer all practical purposes. Plant these in the seed patch in exactly the same way that the ordinary crop is planted. It would, of course, be well to have them dropped at about an equal distance apart, as each hill should have the same comparative amount of land for its development. They should also be cultivated the same as the general crop.

SELECTION OF HIGH YIELDING HILLS.

The next factor of importance in connection with the seed selection is a selection of the high yielding hills in the seed patch, which should, of course, be done at the time of digging. To do this properly it is necessary that the hills should be dug by hand, and the product of each hill laid out separately at the side of the row. If feasible, the entire seed patch can first be dug and laid out in this manner, or the selection can go on while the digging is in progress. To make the selection the speaker would advocate that in the first place all of the hills be examined hastily and the low-yielding, poor hills be taken out. The problem before the man making the selection is, of course, to leave only the best hills. The best hills are naturally those producing the heaviest yield of proper sized tubers which are regular in outline. Hills which show a tendency to produce some very large tubers and many small tubers, are, of course, undesirable, though the total yield may be large. Hills which show a tendency to produce tubers irregular in shape, budding out at the sides, are, of course, undesirable, and should be discarded where this condition is marked. Having these factors well in mind, and they are factors which are well recognized by the majority of potato growers, the operator can pass down the rows and throw out the poor hills almost at a glance, leaving only the good high yielding hills.

After this first process of selection the operator should go over these goods hills and select from among them what Professor Stone calls the "Gilt Edge" hills, that is, those which are the very best in the field from the standpoint of yield and uniformity of product and from each of these "Gilt Edge" hills take the best tubers and retain them for planting the seed patch the ensuing year. After the tubers from the "Gilt Edge" hills have been removed, the good tubers from the remaining good hills should be retained for planting the general crop the ensuing year. This is practically all there is to this method of seed selection and the process should be carried out year after year in the same way.

The proper application of this method will mean that a sufficient number of good tubers should be selected in the first instance to plant a seed patch of about one-tenth the size of the general crop grown. This ratio of size of seed patch to general crop would probably hold in ordinary seasons. Ordinarily about twenty bushels of seed per acre are planted, and one tuber divided into quarters and planted in four hills should produce about twenty good seed tubers. The increase, so far as good seed tubers are concerned, being therefore, about one to twenty. Therefore, by arranging for the seed patch to be about one-tenth the area of the general crop, we have provided for discarding about one-half of the hills in the seed patch. All of the tubers from the discarded hills and all of those which are not retained for seed even from the best hills, are placed with the general crop and sold, so that it will be seen that the only extra trouble and expense connected with growing this seed patch is the planting and digging by hand, and the small amount of trouble required in making the selections. As a matter of fact, this entails very little extra trouble and every grower who is depending for his living upon the crops produced should be willing to take this amount of time to insure good seed.

STORAGE AND CARE OF SEED POTATOES.

The factor of proper storage of the seed is also one generally neglected by growers and is probably no less important. Very few growers give sufficient attention to this matter. It has been found undesirable to store potatoes in large amounts. If they are dug and placed in large piles soon after harvesting, when the weather is still warm, there is danger of their becoming heated and injuring the vitality. If they are placed in large piles in cellars, which is commonly the case, any rot which starts in one tuber is likely to spread rapidly to the others, thus injuring their keeping qualities.

The best way to hold the seed potatoes is, of course, in cold storage, at a temperature of from thirty-five to forty degrees Fahrenheit. Should the temperature fall below freezing for a short time, there would probably be no very serious damage done, as living protoplasm seldom freezes at exactly freezing temperature. It is better, however, not to subject them to freezing conditions. Most farmers probably do not have facilities for putting their seed potatoes in cold storage, and ordinarily fairly dry cool cellars form good alternatives as storage places.

As the select potatoes are dug in the field it would be well to place them in open slat boxes or crates of uniform size which may be piled on top of each other. These can be transferred into the cellar and piled up in a comparatively compact space, and yet the crates will allow a free circulation of air, which is desirable. This method of storage furthermore, allows the grower to examine the seed occasionally during the winter and take out any tubers which may have started to rot before they have had opportunity to affect any of the adjoining tubers. Every precaution possible should be taken to keep the tubers cold, and therefore free from sprouting until about two weeks before planting time. It is of the highest importance that the tubers should not be allowed to sprout in the darkness previous to planting, and if the cellar becomes too warm in the early spring, as is liable to be the case, to hold the seed tubers dormant, they should either be put in cold storage, if such means is available, or they may be stored in pits in the fields, and by proper management kept dormant until it is time to expose them before planting.

It is probably not generally understood that it is important to expose the tubers to light a short time before planting. They should be taken out of the cold storage or cellar from ten days to two weeks before it is intended to plant them, and exposed to the light in some fairly dry warm place. Several experiments which have been carried out at the Cornell Station indicate the effect which may be expected from such exposure of seed.

Professor Gilmore in 1903 carried out an experiment with Maine-grown stock of the Sir Walter Raleigh variety, which was rather interesting. About May 5, this stock, which had been kept in excellent condition, was separated into two lots. One part was simply stored in a cool place in the barn and the other part put into cold storage, until July 6, when both parts were planted. The barn stored seed was considerably wilted; sprouts from two to six inches long had formed, which were most broken off in the course of planting. The cold storage seed was just beginning to sprout into growth. The yields of these two lots of seed from equal areas were as follows: Barn stored seed, wilted and sprouted, 42.5 pounds. Cold storage seed, solid, slightly sprouted, 111.0 pounds.

These figures show a gain of 159 per cent in favor of the solid nearly dormant seed.

Another experiment carried on in 1904 by Mr. S. Fraser of the Cornell Station, is also interesting in this connection. The seed tubers were stored from November to May in crates in a cool cellar. No sprouts had started May first. They were then divided into four lots, one of which was put into a dark cellar, fifty to sixty degrees in temperature; another in a cold frame open above, bottom temperature eighty degrees; another in a barn window, temperature near out of doors; and the last in a greenhouse, temperature seventy to ninety degrees.

The following table shows the comparative yields and the increase obtained by allowing the seeds to slightly sprout in the light. The seed in each case being stored by the methods indicated for thirty-six days, May 2 to June 7:

Seed stored 36 days (May 2 to June 7) in trays as below:

	In dark cellar, 50°-60° Av. of 4 plats, lbs.	Cold frame open above bottom 80° lbs.	Barn clear window temp. near out of doors, lbs.	Green house 70°-90° lbs.
Carman No. 3	15.44	26.50	21.25	16.25
Sir Walter Raleigh	16.74	17.00	20.13	20.25
Average of both	16.09	21.75	20.69	18.25
Increase over seed stored in cellar		5.66	4.60	2.16
Percent gain over seed stored in cellar		35.1	28.5	13.4

The sprouts on all of the tubers exposed to the light were strong, dark green, but were only from one-half to three-quarters of an inch long. On those from the cellar, the sprouts were three to four inches long, white and brittle.

The results of the above two experiments and the results which have been obtained in numerous other experiments, show that it is desirable to expose the tubers for a short time in a light, moderately warm place before planting. If they are to be planted by machinery they should be exposed to the light and warmth before planting only long enough to allow the buds to begin to sprout. If they push out for any great length they will be broken off and injured in the planting. Under ordinary conditions, exposure in a light warm place for from eight to ten days is probably sufficiently long.

The very largely increased yields which have been obtained from seed properly handled and properly selected indicate that there are no other factors more important in the production of a large crop, and potato growers everywhere should be urged to give these factors very careful attention.

SELECTION OF SEED CORN.

Few methods of corn breeding have been suggested which are simple enough so that farmers generally will put them into practice. The methods of corn breeding which have been devised by experiment station workers, true, are by no means complex, at least not for experiment station workers, to manipulate. They are, we may conclude, practical for special corn breeders. But the fact that they are too complex for the use of ordinary farmers is testified to by the fact that there are very few farmers in the country who are using such methods.

It is important that farmers grow their own seed corn or at least use the seed of some variety grown in their neighborhood which is known to give good results. Seed procured from a distance may not be good seed, or may have been grown under entirely different conditions. It is usually shelled so the grower does not know whether it has been shelled from good ears or not. The only way, therefore, of getting good seed is to raise it oneself or buy it from a local man known to be growing a good strain adapted to the locality.

Following is an outline of a simple method of corn selection which the writer believes to be applicable to general conditions and not too complex for farmers to carry out. The method is not advocated as a careful breeding method, but simply as a method of seed improvement.

FIRST METHOD OF CORN SEED IMPROVEMENT.

The grower should select twenty-five of the best ears of corn which he can find by a careful examination of a large quantity of ears of a known good variety. These ears should be solid and heavy for their size, of medium length and of medium diameter. They should have deep kernels and moderately small cob. The kernels should be firmly set on the cob, not moving readily, thus giving a feeling of solidity to the ear. This solidity indicates thorough maturity of ear at husking time. The ear should be cylindrical, have straight, regular rows and be well filled at butt and apex. The grower should study different ears until he has well in mind the best type of ear present in the variety he is growing and each of the twenty-five ears selected should be the best representatives of this type.

If the field of corn is standing from which selections of ears are to be made, the work should be done shortly after the first light frosts or whenever the corn is thoroughly mature. The grower can pass slowly along row after row, stripping down the husks and examining each ear that from outside appearances looks promising. A considerable number of very good fully matured ears should be selected in this way and from these the best twenty-five can be selected for the seed improvement work.

If the corn has been cut from which selections are to be made, it should be husked before any severely cold weather has occurred, as no opportunity should be allowed for the seed to freeze before it is thoroughly dried. After husking, the twenty-five best ears can be selected as before, the early maturing ears being judged by the solidity of the kernels on the cob.

By whichever method the twenty-five ears are selected, when once they are selected, which should have been done before any freezes have occurred, they should be hung up in a warm, dry room, preferably in a room where a fire is maintained for a portion of the day at least. It is important that the ears dry quickly, as this improves the germinability and vigor of the ensuing crop.

Preserve these twenty-five select ears together. When ready to plant, first shell off the imperfect kernels at tip and butt of each ear and then shell the twenty-five ears together, and plant them in a seed patch at some distance from any other crop of corn of any kind. This insures that individuals from good ears will be pollinated and fertilized by individuals from similarly good ears, which is one of the most important factors in the improvement of any crop.

When this seed patch matures it may be husked standing, or cut and husked from the shock as the farmer desires. Whatever method is used the seed should be ready for selection before any severe freezes have had opportunity to affect its vitality. From the corn produced on this patch select again the twenty-five best ears to use the ensuing year in planting a seed patch and select a sufficient number of the best ears remaining to plant the general crop.

All of these ears saved for seed should then be hung up in a heated room where they will dry quickly. Quick drying is such an important thing ordinarily that this should not be neglected.

The above method it will be observed has in it but one process not now followed quite generally by corn growers; this is simply the planting of an isolated seed patch from the best ears so that plants from good ears will be fertilized by plants from good ears. This seed patch need not be very large, only from one-quarter to one acre, depending upon the size of the corn crop grown. If a farmer is planting a large corn acreage and twenty-five ears are not sufficient, a larger number can be selected each year and the seed patch increased in size.

This method is not so complex but that every man who is growing from ten to twenty acres of corn could well afford to put it into practice. It requires little time and extra expense and no note keeping. The seed patch could be cultivated alone or in connection with some other crop, such as potatoes. If planted in hills, the seed patch should be thinned to a regular stand of either two or three stalks per hill, according to the richness of the soil. If drilled it should be thinned out so that there is only about one stalk per foot in the rows. In other words, the stalks in the seed patch should not be crowded.

The general application of even this simple method of seed improvement throughout the country would doubtless mean an average increase of some five bushels per acre in our corn crop.

SECOND METHOD OF CORN SEED IMPROVEMENT.

Select the twenty-five best ears obtainable in the beginning as indicated above, preserving them carefully under the best conditions. When ready to plant, shell these twenty-five ears, discarding imperfect kernels at apex and base, and keeping the grain from each ear in a separate bag. Number these bags 1, 2, 3, etc., up to 25.

1909 OPERATIONS.

We will assume that planting operations begin in spring of 1909. Select a small field where the soil is uniform and which is at some distance from any other corn field, at least from 500 to 1,000 feet, and which is large enough for fifty rows twenty-five hills long. Plant twenty-five hills in each row with five kernels per hill. Rows 1 and 26 should be planted from bag one, rows 2 and 27 from bag 2, and so on until rows 25 and 50 are planted from bag 35. In this way the grower will have left over about one-half of the seed of each ear numbered the same as the corresponding rows. Save this seed carefully, keeping each lot in its numbered bag.

After the corn in this seed patch is well up, thin uniformly to three stalks per hill. Should land be poor, thin to two stalks per hill. Cultivate just the same as an ordinary crop.

In the fall when the crop is mature and before any severe freezes have occurred, husk each of these rows separately and weigh the product, determining which rows have given the best yield. Remember that two rows were planted from each ear to average up the soil conditions. The total yield of the two rows planted from the same ear should thus be taken as the primary measure of the value of the original ear. Considering both yield and character of product determine which of the twenty-five ears planted has turned out the best and select the eight or ten best, making note of the numbers of the rows so selected. Half of the seed of each original ear has been retained, it will be remembered, for further use.

After determining the ten best rows select the best seed ears from these rows and enough more of the best seed ears produced in the remaining portion of the patch to obtain sufficient seed for your entire crop in 1910. This seed should then be dried quickly by hanging in a well ventilated room artificially heated.

1910 OPERATIONS.

Select again, in 1910, a small field at some distance from any other corn field and prepare for planting. Of the seed retained from the ears planted in 1909, take those sacks numbered to correspond with the rows which were selected in 1909 as superior, mix the seed from these sacks together thoroughly and plant in the isolated plot.

By this method it will be noted all of the seed planted will be known to have come from an ear of high producing power and good general character, these points having been determined by test the preceding year.

The general crop this season is planted from the ears selected from the trial plot in 1909.

When the small isolated plot from the select ears ripens in the fall, carefully examine and select the best twenty-five ears which preserve carefully as in other cases for continuing the selection.

After these twenty-five best ears have been selected, sort over the remaining ears and preserve a sufficient number of the best to plant the general crop in 1911.

1911 OPERATIONS.

The twenty-five best ears selected the preceding year should be shelled together in sacks numbered from 1 to 25, the poorly formed apical and basal kernels being discarded. This year the isolated test plat should be planted as in 1909, of fifty rows, twenty-five hills long; rows 1 and 26 being planted from ear 1 in bag 1, rows 2 and 27 with seed from ear 2 in bag 2, and so on. The portion of the seed of each of the twenty-five ears not planted should be retained as in 1909, for planting seed plat in 1912.

When this plat matures in the fall, the product of the progeny from each ear being in two rows in each case, should be weighed up and the separate progenies carefully judged, the eight or ten best being determined as in 1909. After which a quantity of the best ears are selected to plant the general crop in 1912.

The general crop in this year, 1911, should be planted with the second select seed taken from the isolated plat of 1910.

This method of selection it will be observed is a two-year method, which provides for selecting and testing the yield of the best twenty-five ears the first season, and then the next year growing the select seed, as determined by this test, in an isolated plat together so that known good producers will be crossed with known good producers. It provides each year for taking seed corn for the general crop from an isolated plat, where only highly select ears have been planted.

The only element contained in this method which is not also contained in the first method suggested is the growing of a portion of the seed of the select ears one year in numbered rows and testing their transmitting power, so that when the isolated patch the second year is planted it will be with seed of ears of tested producing power. This second method is rather more complex than the first method, but it is still simple and is doubtless preferable where growers will take the time to carry it out. Either of these two methods, however, will certainly give desirable results and may be unhesitatingly recommended, the speaker believes, for the general use of corn growers.

MAINTAINING THE FERTILITY OF MISSOURI SOILS.

(By M. F. Miller, Professor of Agronomy, Missouri Agricultural College.)

The soil is the most valuable asset of the State of Missouri. Upon the fertility of the soil depends the prosperity of the people. A fertile soil insures a prosperous country while an impoverished soil means abandoned farms and an increase in the mortgages of our land holders. It is a fact too well known to need comment that our soils are not so fertile as they once were. In fact, with the increasing price of land, coupled with the decreasing productiveness, the time is already upon us in many parts of the State when a different system of agriculture must be adopted to make farming profitable on the average season. And what is already true of these parts of the State will soon be true in the best parts of Missouri, if we continue to farm as we have been farming.

The Missouri farmer is in no way to blame for the present conditions, as they are simply the result of economic conditions and of the farmers' early training. Pioneers in any new country have their homes to make and on a virgin soil little thought need be given to the effect of any system of agriculture upon the soil. The important thing with them is to subdue the land and bring it into cultivation. And so it was with our fathers, who in turn taught their methods to the younger generation, and we have all been imbued with the idea that the most important thing is to get crops off the soil with little thought as to the effect of cropping on the soil itself. The result has been that our methods have in almost all cases been destructive; that is, they have tended to tear down rather than to build up. It is quite true that so long as a soil is supplied with soluble plant food from year to year this is the most remunerative system so far as the immediate profits are concerned. It is equivalent to skimming the cream, as it were, but such a system cannot last. It is now time that we adopt a different system, that we establish a new ideal in our agriculture, if our lands are to continue to yield a satisfactory income, and if the farming class is to continue prosperous. In other words, we have a new conception of the handling of our soil slowly coming into existence—a conception which looks to the building up and to the maintaining of the soil fertility rather than to the tearing down of the soil for the purpose of securing an immediate crop, which has been our conception up until recent times. It is quite true that this new idea regarding the handling of our lands is being forced upon us, and the only reason that it will appeal to the average farmer is that through this constructive method of agriculture only can he expect large profits from now on. In other words, the man who expects to farm for the next twenty years will find that he will make more money by following the system of keeping up the soil than can possibly be made by the old system. It is well enough to talk of the importance of soil conservation for future generations, but it takes a direct appeal to a man's business judgment in order to be sure to gain his attention. It is just such an appeal that the new idea in the handling of our soil will make to the man who considers the matter with an open mind.

There is another phase to the matter of maintaining fertility which should appeal to every farmer who is interested in the welfare of the future citizens of Missouri. I like to think of the land which we own as just so much of the State's domain for which we are responsible during our lifetime, and, if possible, we should manage this so as to leave it to our children in as good or in a better condition of fertility than that in which we found it. If a man can do this he has shown himself a public benefactor —a true citizen of this State. If, on the other hand, his land is left to his children in a poorer condition than he found it, such a man has not fulfilled his duty as a citizen. If the man who builds up the fertility and the productiveness of his land is a public benefactor, then he who willingly and knowingly tears down the fertility of his land and leaves it to future generations in a poorer condition than he found it could almost be termed a public curse.

I do not mean to say that there is never an occasion for a man to practice what might be termed the destructive system of agriculture, for I realize most fully that it is sometimes necessary, even for the man who is sufficiently well informed on agricultural practice, and who would prefer the constructive method. A young man going on to a farm with a heavy debt must frequently farm the land hard for a time; he must meet his interest; he must pay for improvements; but the great difficulty is that too often when men begin in this way the habit becomes so firmly fixed that it is impossible thereafter to change. We, therefore, have the man who continues to skim the cream from one farm that he may buy another, and then continues the same practice on this that he may buy a third, and so on. Such has been the practice of the so-called progressive or prosperous farmers, and while I am not laying blame on such men for the ideals which they have held, and while I realize that such men have been largely instrumental in giving us our present prosperity, I do contend that for the coming generation this ideal is wrong, and that these methods are no longer suited to the conditions which we must meet in the rapidly changing order of our agricultural development. What the young man needs to do, after he has his mortgage lifted, is to begin again to build up the land that he has depleted, and his ambition should never be satisfied until the land is again as fertile, or more fertile, than when he first went on it. If it is ever necessary to follow the destructive method for a time it should be replaced as soon as possible by the constructive system, and the land left to one's children in a high state of fertility. A fertile farm is a much better legacy to leave our children than a worn-out farm and a swollen bank account.

But there is another class of farmers which must be mentioned in considering this constructive ideal of modern agriculture, and these are the men who, either through lack of knowledge or lack of business ability, are not able to build up a farm and make it pay dividends at the same time. In fact, with lands already badly worn, it requires all the business judgment and the knowledge that a man can bring to the management of a farm to make it pay its way while it is being improved; but it can be done, and it must be the business of our agricultural colleges, our schools of agriculture, our agricultural high schools, and sometimes possibly of our common schools, to so train our young men that they will be able to farm in a constructive way, and at the same time make abundant returns from their lands. The average farmer of today can not do it; the farmer who has passed middle life, as a rule, will not do it, so that it falls upon our young men and boys to be the ones who shall lead us out of the difficulties into which our destructive methods have led us.

I do not wish to paint too gloomy a picture or to be too pessimistic, for I am not a pessimist. I believe that in this gradual change in methods which will come, a great many who do not, or who by reason of circumstances or training, cannot, heed the signs of the time, will suffer; yet I believe that the thinking Missouri farmer will see that his sons will be so trained in those things that have to do with his business that they will, as a rule, be able to handle the problems which present themselves, and I look forward to the coming generation of American farmers as the most prosperous in the history of the world. It is high time, however, that we were up and doing, if this goal is soon to be reached. Every year of the old system sees a further wasting of fertility and throws added hardships upon the generations that are to follow.

But the practical question which will at once be asked by the man who wishes to practice a constructive system is, How can I build up my lands and make a profit at the same time? Most of us are not farming for amusement, but for the profit; and the thing that always appeals to us is the business side of any practice. It is well enough to talk of building up land, but we are not, as a rule, philanthropists, and we must find a method by which this can be done economically.

Naturally, there is no one method adapted to all soils, to all conditions; in fact, there are scarcely two farms where exactly the same methods will apply. Consequently it is the fundamental principles that we must know and be able to apply to the particular conditions under which we are required to work, and the man who is willing to experiment the most, to read the most, and who is able to observe most closely, is the one who is to go forward most rapidly.

Four years ago the State of Missouri began a systematic study of the soils of the State, including, among other things, the mapping of the soil types as they exist, accompanying this work by a careful study of these various types to determine not only their character, but through field experiments in the various parts of the State, to find the systems of cropping and method of soil treatment which shall be most remunerative and which will at the same time serve to build up the land from year to year. These experiments have now been in progress for four seasons, and while this is entirely too short a time to allow of sweeping conclusions, yet some very valuable data has been secured. It is some of the general conclusions from the results of the various experiments on these experimental fields, together with the studies of the soil types which have been made, that I wish to bring before you.

THE COMPOSITION OF MISSOURI SOIL.

The investigations into the composition of Missouri soils, while showing a very wide variation in the proportions of nitrogen, phosphorus and potassium present, bring out certain features that are true quite generally of all soils. The first of these is the almost universal lack of humus and nitrogen, due, in most cases, to excessive grain cropping, to a lack of systematic rotation, and the wasting of farm manure. It is a well known fact that whenever a soil is stirred, as in plowing and cultivation, the decay of the humus is hastened, and while this decay is absolutely essential to the making available of the nitrogen which the humus contains, as well as in aiding in the solution of both phosphorus and potassium from the mineral particles, some means must be provided for replacing from time to time the humus which is thus removed or the soil will soon show a lack of humus and a decreased productiveness. Exactly this thing has happened over a great deal of

Missouri, and our lands are showing a decreased productiveness primarily because of the lack of humus and of nitrogen. The building up of the humus is, therefore, the first and most fundamental principle that must be adopted in a constructive system of agriculture.

A second general feature which characterizes practically all Missouri soils is a deficiency of phosphorus. This lack is an inherent one, due to the character of the rocks from which the soils were formed, and to the methods of soil formation, rather than our system of cropping. It is true that our constant grain growing has tended to intensify this lack, especially through the removal of the available portion, and it is, therefore, the deficiency in available phosphorus, rather than a lack in the total phosphorus supply, that is limiting our crop production. The fact that the best system of agriculture we can adopt still tends to a gradual loss of phosphorus through the bones of animals as they are sold will, doubtless, sooner or later, drive us to the returning of some phosphorus to our soil in a commercial form, and in many parts of the State this practice is already highly remunerative.

The potassium is abundant in practically all Missouri soils excepting those of the Ozark upland, and it is simply necessary to practice the proper system of agriculture to make it available and to maintain it indefinitely. The feeding of crops, the maintenance of a high humus content, good drainage and proper cultivation will maintain the available potassium supply practically indefinitely except in some of the Ozark uplands mentioned and on certain of the more sandy soils of the State.

The lime content is also sufficiently high for the present, in most cases, and thus far only rather limited areas—notably those of the flat prairie land of Southwest Missouri and some of the Ozark uplands—seem to be in need of this element. Any intensive system of agriculture tends to a gradual removal of the lime content of the soil, but most Missouri lands are sufficiently well supplied to obviate the necessity for its use for a considerable time to come.

METHODS OF MAINTAINING FERTILITY—CROP ROTATION.

The first essential to any rational constructive system of agriculture is a more or less systematic crop rotation. The following table shows the results of seventeen years' cropping of the upland soil at the Missouri Experiment Station under different systems:

Rotation.	Yield in Bu. per acre 1905.
Plot 1 Corn, 17 years	11.8
Plot 2 Corn, wheat, clover, 17 years	50.7
Plot 3 Corn, oats, clover, wheat, timothy, 17 years	54.2
Plot 4 Corn, wheat, clover (manured) 17 years	77.6

These plots lie side by side, the only difference being in the system of cropping, and, in the case of plot 4, to the addition of manure.

The benefits of a rotation arise mainly from a better maintenance of the humus supply, and not to a saving of plant food. As a matter of fact, a rotation of crops is usually more exhaustive of phosphorus and potassium, especially, than is straight grain farming, but the nitrogen that is added through the legume crops introduced, such as clover and cowpeas, tends to maintain the nitrogen supply somewhat, and the larger amount of humus maintained tends to keep available larger amounts of plant food of all kinds. It should be remembered, however, that no crop rotation will maintain fertility indefinitely if the crops are continually removed. It is, however, the first method we usually adopt in the building up of our lands, and many farmers, seeing the immediate benefits that are derived, conclude that a "change of crops" is the only essential to a permanent productiveness. This is far from true, and there are thousands of farmers in the east who can testify most truthfully to this fact. A crop rotation is only the first essential to the maintenance of the fertility of our lands.

THE USE OF LEGUMES.

No rotation is complete unless it contains a legume crop, such as clover or cowpeas, once in three to six years, and the more often such crops occur the better, providing they are put to the proper use. The immediate effect of the legume is to set free available, soluble nitrogen as its roots decay in the soil, and thus supply to a considerable extent the crops which follow. Hence we get the great benefit of a clover crop preceding corn or a cowpea crop preceding wheat. Analyses show, however, that the large portion of nitrogen in all legumes is in the tops, rather than in the roots, and that a certain share of the nitrogen even of legumes comes from the soil; hence the growing of legumes and the constant removal of the crop as hay does not tend to build up soil permanently. The immediate benefit is due to the soluble form of the nitrogen left in the legume roots possibly to the bettering of sanitary conditions of the soil, and to the fact that the amount of nitrogen is somewhat larger than in the roots of other crops, so that the effect is very perceptible on the crop following. The actual effect upon the soil, however, is to cause a more rapid removal of the phosphorus and potassium supplies due to the larger crop yields secured, and thus give a stimulative action, rather than a permanent building up of the soil's productiveness.

THE FEEDING OF ANIMALS.

The consideration of the effect of legume crops as well as of grain and grass constantly removed from the soil, suggests the next essential in a constructive system of agriculture, namely, the feeding of crops on the farm. No rational system of agriculture according to our present knowledge omits the feeding of farm animals and the return of the manure to the land. When crops are thus fed, the resulting manure will contain approximately 80 per cent. of the nitrogen, 75 per cent. of the phosphorus and 90 per cent. of the potassium existing in the feed, and if this manure is carefully returned to the land, either by the animals themselves as they run in the pasture or by the manure spreader when fed in lots or stables, the farmer is saving approximately four-fifths of this plant food which would be removed if the crops were sold. And in the case of legumes which secure from the air a large share of the nitrogen found in their tops, when these are fed back on the land there is an actual building up of the nitrogen content of the soil. It is not for me to enter into the economic results of a system whereby every good farmer is a stock feeder but I will venture the opinion that an over-production of meat is very unlikely with the increasing population. Be that as it may, the fact remains that the man who is to farm most constructively and intensively for the next twenty-five to fifty years must be a stock man. The time may come when science will change our methods in this respect, but for the present there is no way for the general farmer to build up land economically without the feeding of animals. In a word, all our roughage and all grains excepting possibly wheat, and of course such small seeds as clover and grass seeds, should remain on the farm and either be fed, or as in the case of the coarsest material such as straw, they should be used for litter in stables and thus returned.

It has been the policy of too many of us to feed cattle or hogs when the live stock market was high and sell grain and hay when the cattle market was low, and according to the old point of view this was good business. With the constructive idea of soil handling we continue to feed regardless of the market, the price of stock affecting our farming operations only in the selection of the kind of stock to feed, whether we shall specialize on sheep, for instance, or on hogs, or on cattle. In other words, we must feed as a policy from which we never err, although markets and various other conditions will determine whether we shall handle one line of stock continually as a pure bred line, or whether we shall handle several lines, whether we shall finish animals or sell young stuff. All these things must be determined by conditions, and herein lies the opportunity for the farmer to succeed or fail depending on his business judgment and his ability; but the policy to keep his grain and roughage on the farm should be practically ironclad, after he has once become so established financially as to make this possible.

THE SAVING OF MANURE.

In order to maintain soil fertility most readily we must give more careful attention to the saving of farm manures. Too often where a system of feeding is practical the manure is allowed to lie around in the lot until a large share of its fertilizing constituents have washed away and on hundreds of farms the manure piles are entirely ignored. The manure spreader is as necessary on a well regulated farm as is the binder or the mower. The old method of hand-scattering manure on the thin spots only must pass. Manure must be made to go farther and the policy should be to cover every acre uniformly once in the rotation. There are only two methods of doing this economically; one is to allow the animals themselves to scatter it by feeding directly on the land, a method that can be adopted with only partial success, and the other is by means of a manure spreader. There are three important reasons, in my opinion, why we should adopt a manure spreader as a necessary implement on the modern farm; first, manure spread evenly and rather thin over a large area brings a greater return ton for ton than when spread irregularly and heavily; second, when a man owns a manure spreader he is much more careful about saving manure and putting it on the fields at the proper time; and third, the spreader saves labor. Most farmers consider the last reason very important. In my opinion it is the least important.

Manure should be hauled directly to the fields as it is made where this is possible as in this way there is the least loss by fermentation and leaching. If it cannot be hauled every day it should be hauled every week or as often as possible. Where animals are fed in stables a manure carrier that dumps directly into the manure spreader is the modern thing. Where cattle are fed in large sheds the manure may be allowed to accumulate and be hauled when most convenient in the year as there will be very little loss under such conditions. Manure kept tramped compactly and mixed with a fair amount of litter and liquid manure under cover will as a rule, lose a minimum amount of fertilizing materials.

THE USE OF COMMERCIAL FERTILIZERS.

The increasing use of commercial fertilizers in Missouri is a cause for alarm among those who are interested in the future of the State. The reason for this is found in the fact that as fertilizers are used it is for the effect upon the immediate crop with no thought of the future. Moreover, when they are found to pay, as they usually do on worn soils, there is a strong tendency for the farmer to continue their use year after year, to the neglect of his farm manures. It should be remembered that the chief function of fertilizers is to supply soluble plant food, and where a soil is lacking somewhat in one or more of the elements of fertility in soluble form, due to too much grain farming or other cause, the addition of such element or elements in the form of a fertilizer may bring large returns. Consequently the farmer becomes enthusiastic in its use and continues the practice, depending far too largely upon the fertilizer for his crop. The final results of such a system is exactly the same as the growing of clover and removing it from the land;—the soil is stimulated to larger production of crops following, the humus supply is neglected and burned out, and the fertilizer at once assumes the role of a soil stimulant rather than a soil builder, with final disaster to the farmer and to the land. In other words, fertilizers thus used may postpone for a time the failure of a soil to produce satisfactory returns, but only for a time. Such a use of fertilizers is perfectly legitimate for the man who is just paying for his land and must meet his obligations, but it must be clearly understood that this is a temporary expedient and one that cannot be continued if his land is to permanently maintain its productiveness. The proper use of commercial fertilizers, on the other hand, is a constructive one.

That is, the fertilizer is used as a soil builder rather than as a temporary ameliorant, and such a use is in connection with the best system of crop rotation, or legume growing, of animal feeding and of manure saving that a man can practice. When a man has done all that he can to maintain the nitrogen, the phosphorus and the potassium supplies of his soil by intelligent soil management and still finds that he is not quite maintaining the supply of any one or more of these plant foods, he can resort to the use of commercial plant food and be assured that he is practicing a constructive system, one that will not only increase his profits but permanently benefit his land.

METHODS OF SOIL MANAGEMENT.

It is always of first importance to understand the reasons for doing things—the fundamental principles—but it is also of importance to know how to do. Unfortunately, in a business as complicated and as dependent upon seasons and upon soil differences as is our modern agriculture, only very general directions as to exactly how to manage our soils can be given. Nevertheless, from the results of the various soil experiments, we are coming into a position where it will be possible to give very concise directions regarding the handling of this or that soil.

In the first place, in building up the humus or nitrogen supplies of our worn lands, we are resorting to the growing of legumes —mainly cowpeas—and plowing them under. There is no more rapid method of building up humus. However, where a man must have some immediate returns from the land, the next best system is the pasturing of the crop, in which case approximately 85 per cent. of the nitrogen and a large share of the humus is returned in the manure and stalks of the plants. Such crops are as a rule grown both as a regular crop in the rotation, and also thrown in as catch crops wherever possible. Cowpeas sown in the corn at the last cultivation to be pastured off with hogs or sheep can be used with very great profit to the land. Sometimes cowpeas may be sown alone after a crop like wheat and pastured off, or they may also be planted with the corn in the hill or row and both corn and peas hogged down with excellent results.

A practice we have found especially adapted to the building up of thin land is to sow to rye and pasture up until May, then plow and sow to cowpeas, pasture these, disk the land, harrow and again sow to rye. Two or three years of such pasturing will rapidly build up the humus and nitrogen. Wheat may be used instead of rye in this case if desired and it makes even better hog pasture. Wheat and rye can also frequently be used to cover corn land in winter and spring and thus prevent washing, saving nitrogen and building up humus.

A rotation which we have found of special value as a soil builder on many of the worn uplands of the State is as follows: Corn the first year with early cowpeas sown at the last plowing with a five-hoe drill, and pastured off with hogs and sheep. If the pasturing is done early, rye or wheat may be sown after the cowpeas are off and pastured until May, when the land is broken for a regular crop of cowpeas the second year. The peas are cut for hay to be fed back on the land or they may again be pastured and the land prepared for wheat with disk and drag harrow. The third year the land is in wheat, the fourth year in clover, while the fifth year it may either be returned to corn, or if timothy has been sown with the wheat it may stand the fifth year as a mixed hay or pasture. The value of this system, however, depends absolutely upon the returning of the crops to the land by pasturing or feeding, and since all legumes add nitrogen the more often they occur, providing they are fed back, the more rapidly will the land be built up in its nitrogen and humus supplies. In other words, if a liberal use is made of legumes, all crops fed on the farm and the manure scrupulously saved, the farmer is independent of the fertilizer dealer so far as his supply of nitrogen is concerned, while his humus supply will likewise be maintained.

PHOSPHORUS IS PROFITABLE.

Attention has already been called to the fact that the soils of Missouri are almost universally low in phosphorus and high in potassium. It has also been shown that in feeding crops only about 75 per cent. of the phosphorus is returned in the manure, while practically 95 per cent. of the potassium is thus brought back. Evidently, then with a proper system of feeding and manuring, the need for potassium, at least on all soils heavy in clay, will probably never be felt, but in the case of phosphorus, the very best system of animal farming that can be devised, unless it be one in which considerable amounts of feed are purchased from outside sources, allows of an appreciable loss of phosphorus each year through the bones of animals, or more rapidly through the sale of grain. Hence we are losing to an appreciable degree the very elements in which our soils are naturally deficient. The result will be that sooner or later we shall be driven to the purchase of some commercial forms of phosphorus to make up this loss. Indeed as our experiments plainly show our soils will already respond more quickly to the application of this element than to any other and on the average Missouri upland that system of farming which will ultimately prove most profitable will be one in which the phosphorus supply is thus maintained. The form of phosphate to use will depend somewhat upon the system of farming, but in most cases some cheap phosphate, such as rock phosphate or basic slag applied with manure, will be most remunerative. The Tennessee rock phosphate can be secured in Missouri for about $10.00 per ton in car lots and where a man is feeding in a shed or stable the phosphate may either be scattered over the manure from time to time as it is made, or it may be scattered over the manure in the spreader as it is loaded, applying it at the rate of from 50 pounds to 100 pounds per ton of manure. Bone may be used but it is usually better to apply this bone with a fertilizer drill directly to the soil shortly before or at the same time the crop is put in.

I do not maintain that it is necessary to add phosphorus on any soil of the State to secure fair returns from it, if the proper system of rotation, legume growing and cattle feeding is adopted, but I do maintain that on all soils that are strikingly low in phosphorus its use will in most cases pay immediate profits and that where the phosphorus unavoidably removed in the best system of agriculture is returned in some commercial form or in feeds purchased the productiveness of the land will be measureably increased.

I am very well aware that many of the methods I have suggested will be considered not only impractical but unnecessary by many men who have all their lives been practicing other systems. I know many men, too, who having gone on land that was not in its highest state of fertility and who by simple rotation and only partial feeding have seen the land increased in productiveness until it is better today than it was fifteen or twenty years ago. Such men think they have solved the problem of maintaining soil fertility, and, so far as the span of their own lives is concerned, this is doubtless true; but should their boys continue this same system for another generation its shortcomings will become apparent, just as they have become apparent on thousands of farms in the east. And whatever may be our theories, or the observations of a single lifetime, the history of the farms of the eastern states has shown us that no system of agriculture is permanently profitable which does not maintain fully the humus supply as well as the supplies of nitrogen, of phosphorus, of potassium and of lime in the soil. The exact system of rotation, of feeding, of farm management which will bring this result with the greatest net profit each man must work out for his own conditions. And as time goes on a man's success will depend more and more upon his ability to do this. Shall we not, therefore, train the rising generation with the ideals of a constructive system of agriculture and in so doing make it possible for them to reap the fullest rewards from their labors and to thus insure the future prosperity of this great State?

DISCUSSION.

Q. I would like to ask Prof. Miller what he calls an average soil.

A. The average soil of Missouri, all over the State, would contain around 3,000 pounds of nitrogen, 1,000 of phosphorus and 5,000 of potassium. In Barton county there are 445 pounds of phosphorus to the acre near Lamar; and near Adrian, Bates county, there are 698 pounds. But the above is an average for the State.

Q. How much phosphorus did you say to use on an acre of average Missouri soil?

A. Sixty to seventy pounds of phosphate rock per ton of manure.

Q. Would that be enough to supply the needs of a five-year rotation?

A. Yes, if you feed everything back except wheat.

Q. Do you apply manure once in five years?

A. Yes, once in a five-year rotation, and that before corn.

Q. Do you have to buy rock phosphate in car loads?

A. Yes, to get the price of $10. If you buy in small lots it will cost you in the neighborhood of $15 per ton, freight included.

Q. Is one form of phosphate rock better than another?

A. Yes, there is some variation. We have been buying from Tennessee.

Q. After you have succeeded in getting a crop of cowpeas how do you treat the land to get the best results?

A. Either "hog" them off or take off with sheep.

Q. Would you advise burning stubble off of lands?

A. No; it is never wise to burn off anything. It depends somewhat on the system you are figuring on. If you want a crop the next year it will sometimes pay; but if you are figuring on crops in the future it never pays.

Q. Suppose we fed more back on the soil than we raised—would we increase the fertility?

A. Yes; if a man is able to do that, he builds up the fertility. One of the ways you can keep up the fertility is by buying feed, although it is tearing down the one man's farm to build up another. If you can adopt a system whereby you can make money by buying feed it is all right.

THE RELATION OF SOIL TO ALFALFA GROWING IN MISSOURI.

(By C. B. Hutchison, Assistant, Dept. of Agronomy, Missouri Agricultural College.)

Alfalfa is one of the most important forage crops that the Missouri farmer is growing today. Its wide adaptability for feeding to all classes of farm animals, its high feeding value and its renovating effect upon the soil make it a very desirable crop to grow. In many sections farmers are realizing this and are sowing more of it every year. With the increased interest taken in it the characteristics and requirements of the plant are being better understood and it is now grown successfully in many sections where a few years ago it was thought impossible to grow it. Every year it is coming to occupy a more important place in systems of farm management in those sections of the State best adapted to its productiveness, and there is no doubt that it will soon be grown to a greater or less extent all over the State. Alfalfa can be made to grow on practically every soil type in the State but there are some on which it is not a very profitable crop.

ALFALFA—EFFECTS OF CULTIVATION.

Notice the crab grass on the uncultivated plot and the rank growth of clean alfalfa on the cultivated plot.

A few years ago the Experiment Station, co-operating with the farmers of Missouri, started a number of alfalfa experiments covering all of the soil types of the State with the idea of determining the best methods of securing a stand on these different soils. The results of these experiments show that a distinct relation exists between soil types and the successful growing of this crop, and it is the purpose of this paper to discuss this relation.

ESSENTIALS ARE: DRAINAGE, RICH SOIL AND INOCULATION.

There are perhaps three essentials to the successful growing of alfalfa—drainage, rich soil and inoculation. This crop needs a deep, loose, well drained soil. Alfalfa roots go deep into the soil and the plant gets moisture from below. For this reason it thrives so well on the semi-arid regions of the west. On wet lands where the underground water is near the surface the plants never do well and soon die. Alfalfa is not grown successfully on our flat prairie soils, which are poorly drained. These soils are underlaid with a stiff clay subsoil in which the water level fluctuates, often rising on the roots and drowning out the plants.

Another requisite for the successful growing of alfalfa is rich soil. Especially is this true in starting the crop. It may be started on thin land deficient in humus and nitrogen but which contains a sufficient supply of mineral elements of plant food, but under such conditions it starts very slowly and will rarely produce profitable crops. In practically all such cases, however, crab grass and foxtail will come in so thickly as to crowd out the alfalfa before it can develop a good root system and become supplied with nitrogen-gathering bacteria sufficient to make a thrifty growth. In Missouri, where the conditions are not so favorable for alfalfa as in the west, it is necessary for the plant to get a good start from the first, and hence a rich soil is necessary for its growth. Alfalfa is a heavy feeder on nitrogen and phosphorus—two elements that are deficient in most Missouri soils. It is also a rather heavy feeder on potassium, but there is an abundant supply of this element in most of our soils, so nitrogen and phosphorus become the limiting elements. On the upland soils, then, an application of manure, and in some cases manure supplemented with bone meal, has been found necessary to secure a good stand. Manure furnishes the young plant with nitrates until it can become well established in the soil and supplied with its own nitrogen-gathering bacteria. On the better soils, however, where the plant food has not been so depleted, a good stand of alfalfa may be secured without manuring or fertilization.

The third and perhaps the most important factor controlling the growing of alfalfa is inoculation. By inoculation is meant putting into the soil the nitrogen-gathering bacteria that live in the roots of the alfalfa plant and furnish a part of the plant food. Many soils on which alfalfa has never been grown do not contain these bacteria and hence it is necessary to supply them before the plants will thrive well. Inoculation is essential on practically all upland soils in Missouri. The most practical way for the farmer to inoculate his land is to scatter soil from an old alfalfa field over his ground before seeding. This may be applied at a rate of 300 pounds to 400 pounds per acre and should be harrowed in immediately since exposure to light kills the bacteria. The bacteria which soil contains multiply very rapidly and soon the new field is thoroughly inoculated. If it is not practical to secure soil from an old alfalfa field some taken from patches of sweet clover found growing along roadsides or railways may be used. The same bacteria that live on this plant live also on alfalfa. There is no need of fearing to infect the land with sweet clover as this plant is an annual and may be readily killed by mowing before the seed has matured. Artificial culture of these bacteria are now made which the farmer may secure, sprinkle over his seed and thus inoculate them in this manner. This method of inoculation is still in the experimental stage, however, and we have not found these cultures a success in every case, so that their use is to be recommended only experimentally. Only about 25 per cent of our fields on which this culture was used have shown any benefits from inoculation while soil from old alfalfa fields has given results on 85 per cent of the fields inoculated in this manner. This may be due to the improper methods of handling, but the average farmer will secure better results by using the soil rather than treating the seed with this culture.

LIME IS REQUIRED.

Perhaps a fourth essential to the production of alfalfa is abundant lime in the soil. In many of the eastern states an application of lime is necessary to secure a good stand. However, most Missouri soils, except a few that are poorly drained, have an abundant supply of lime and our experiments show that only in a few cases is lime necessary. It is sometimes beneficial for correcting the acidity of the soil but only in this way. Lime is not a controlling factor in alfalfa growing in Missouri as in some states.

These experiments have shown that some soils of Missouri are much better adapted to growing alfalfa than others. In some sections it is a profitable crop to grow without an application of manure or fertilization. In others an application of manure and bone meal have been found beneficial while in still others manure is essential to its successful production. This is due to the fact that some soils are naturally much more fertile than others and some that were once fertile have been run down by continuous cropping for a number of years.

ALFALFA SOILS.

Alfalfa is best adapted to a deep, loose, fertile and well drained soil. Probably the best soil in the State for alfalfa is the land which has from 12 to 15 inches of rich black sandy loam, preferable bottom soil, underlain with a layer of sand. Such soils occur along the Missouri and Mississippi rivers and it is on this soil that alfalfa reaches its highest development in Missouri. This land produces in favorable seasons from four to five cuttings, averaging from 1 to 1½ tons per acre to the cutting. A good stand is readily obtained in these sections with no soil treatment other than good preparation of the seed bed.

The next best alfalfa soils in Missouri are the heavier bottom soils along the creeks and rivers within the State. These soils, while fertile, are hardly so well drained as those underlain with sand, hence hardly so well adapted to alfalfa. However, where well drained, alfalfa is grown on these soils without manuring or fertilization.

The loess soil which comprises the river hills along the Missouri and Mississippi rivers is also well adapted to alfalfa. This soil is fertile, deep and well drained and usually contains a sufficient amount of nitrogen to produce good crops without the use of manure. This is the best upland soil in the State for alfalfa, and experiments in Andrew, Holt and Saline counties indicate that in most instances manure is not needed. The loess soil, however, does not generally contain the nitrogen-gathering bacteria and responds readily to inoculation.

The next best alfalfa soil in Missouri comprises the prairies of the northwest part of the State. Our experiments indicate that most of the soils respond to an application of manure, which, though not always necessary to secure a good stand, gives sufficient increase to make its use profitable. The humus and nitrogen content of these soils is somewhat lower than the bottom lands and hence manure will often give good results.

The Northeast Missouri prairie soils do not generally grow alfalfa as well as those of the northwestern part of the State. Here the nitrogen content has been run so low by continued cropping that there is not a sufficient amount of nitrates present to start the young plants off well, hence an application of manure is necessary in most places in this part of the State to secure a good stand. The alfalfa on the untreated plots of our experiments on these soils seldom succeeds in becoming established and soon dies. An equally important factor, however, in this part of the State is drainage, many sections being too flat and poorly drained for alfalfa.

The poorest alfalfa soils in the State are found in South Missouri. The ridge lands of this section are the poorest of all our soils and hence are the least adapted to the growing of alfalfa. With the liberal use of manure and inoculation it can be successfully grown in many places, even on the slopes of the Ozarks. But generally speaking it cannot be said to be a profitable crop for this section. However, one field sown on a southern slope in Phelps county which has been standing for four years produced three cuttings last year averaging a ton per acre to the cutting.

The Missouri farmer is learning to grow alfalfa quite successfully. With a better understanding of the requirements of the plant it is only a question of time until it will be grown in practically all parts of the State. In North Missouri it will be grown on practically all well drained soils while in Southern Missouri its successful cultivation will doubtless be somewhat more restricted. It is generally true that the longer alfalfa is raised on any farm the more readily it grows and the easier it becomes for the farmer to get a stand. This is due largely to the fact that he learns better how to seed and handle the crop, and the land becomes more thoroughly inoculated and better adapted for growing alfalfa.

DISCUSSION.

Q. Have you had any reports on the soil testing work on the Vandalia prairie?

A. Yes, we had some experiments on that soil, and have not as yet found alfalfa to be grown there very successfully. One experiment there has shown that lime is especially beneficial to that soil. Much of that Vandalia prairie soil is acid and we need first to apply lime to correct the acidity before we can grow alfalfa. The matter of drainage is another important point that will have to be worked out there before alfalfa can be successfully grown.

Q. About how much lime should be applied per acre?

A. About two thousand pounds of ground limestone per acre.

Q. How can you thicken a stand of alfalfa?

A. It may be thickened by cultivation, but it is rarely if ever profitable to try to thicken alfalfa by sowing more seed. You had better plow it up and sow again, and the second time you sow it on that soil you will usually get a much better stand than the first time, because the land seems to become better adapted to the crop, more thoroughly inoculated.

Q. Is it possible to inoculate ground by seeding alfalfa on it, and placing manure on it which is from alfalfa-fed animals?

A. Yes, in a way. In curing alfalfa there is more or less of the bacteria from the soil get on it; and when exposed to the light so much so many of the bacteria are killed that I should say that there is very little inoculation in that manure.

Q. How can you tell when the bacteria are there?

A. They produce small nodules on the lateral roots that go through the soil nearest the surface. They are never found on the tap roots.

Q. In inoculating this soil, you speak of sowing it on the soil and harrowing it in; would it not be better to sow with a drill?

A. That would do just as well. If you will dry it out thoroughly, you will get it fine enough to run through the drill. Drying will not kill the bacteria, but the light will, and if you scatter it on your soil broadcast and let it lie for more than one-half hour, if the sun is shining it will kill bacteria.

Q. Is there any difficultly in growing alfalfa on tile-drained land?

A. No, I think not.

Q. What plan would you suggest to kill crab-grass in alfalfa?

A. We have found that the best way is to go in with a disk or a common spring-tooth harrow, and cultivate after each cutting. That gets rid of the crab-grass, and at the same time it loosens up the soil and conserves the moisture and brings the next crop of alfalfa on in better condition.

Q. Do you find any difference between the usefulness of the spring-tooth harrow and the disk for this purpose?

A. Not a great deal. If there is any difference it may be in favor of the spring-tooth harrow. There is a regular alfalfa disk put on the market now which consists of a spiked disk, and this machine is used quite extensively in the west; but here in Missouri it would hardly be profitable for farmers to buy a machine especially for alfalfa, when the work can be done just as well with your disk.

Q. Don't the disk cut the joints off of the alfalfa?

A. You should disk after each cutting. The disk will spade up the ground, but that is just what you want—it thickens the stand, and that is one of the benefits of cultivation. You do not want to turn the disk as many times as you would on other land that you wanted to cultivate thoroughly; do not set the disk straight, because then it won't get into the soil.

Q. Is it a wise thing to put the disk on before you get a stand?

A. Well, you get the first stand so early in the season, that the ground is not in a condition for the disk. A few years ago, at the experiment station here, we were ready to cut the first stand by the last of April.

Q. Is it necessary to apply manure only at the start?

A. In the first place, it is necessary to have a good seed-bed, and the manure is perhaps of not any more importance than the inoculation. You must have both to get a good stand especially on our average upland. If you have a good, sandy loam bottom soil, you will not find either of these necessary.

Q. Do you top-dress every year with manure?

A. No, we do not find it profitable to let alfalfa stand more than four or five years. If you want to apply manure, put it on before you plow. Plow deep and turn it under, and work down well so as to get a good seed-bed.

I might give you Mr. Wing's rotation: It is corn and alfalfa. After alfalfa has been standing for four years, he plows it up and puts in corn the first year, then the second year he gives a good coating of manure, puts it back in corn, and sows alfalfa in the spring, and cuts a good crop that year.

Q. Do you advise spring or fall sowing in Missouri?

A. We have found fall sowing best adapted to Missouri conditions—about the first of September. It may be that when we get our plains here so well adapted to alfalfa growing, so thoroughly inoculated as Mr. Wing has his, we will find spring sowing profitable, but until that time we will get better results by sowing in the fall.

Q. What brand of alfalfa is best for Missouri?

A. That grown nearest home—in Kansas or Nebraska. While the varieties grown farther west are hardier, and can withstand the heat of summer and the cold of winter better, it has been found that in the west and central parts of the State that our home-grown seed is the best.

Q. What would be the effect on the soil if kept long in alfalfa?

A. It would be depleted. Alfalfa is a very heavy feeder, and its continued use, as in the case of clover, would deplete the soil particularly in potash and phosphorus.

Q. Do cattle bloat by pasturing on alfalfa?

A. Yes, it is a hard matter to pasture alfalfa successfully.

CORN VARIETY TESTS.

(By H. D. Hughes, Assistant Professor of Agronomy, Missouri Agricultural College.)

For years men have recognized the distinct varieties of farm crops and the distinct breeds in the animal world. The sheep man has recognized a distinct difference between the Merino and the Shropshire; the horse breeder has recognized the fact that a Clydesdale is distinctly different from the Percheron, and each is bred for a different purpose. We have certain breeds of cattle which produce milk very much more abundantly than certain other breeds; and again, one breed of dairy cattle produces cream in much larger quantities than another. And we have probably recognized these differences in our live stock more than in our farm crops. The study of breeds is an old study—probably 5,000 years old, at least; while for certain well known reasons, a study of corn is practically new, and, therefore, we have given it so little attention that many of us have not realized that there were as great and distinct differences between our varieties of corn as between the different breeds of farm animals.

That this difference is even more distinctly and closely defined than with our farm animals can, I believe, easily be shown. In looking over the reports of the experiment stations of 32 of our states wherein over 200 varieties were reported, I find no one

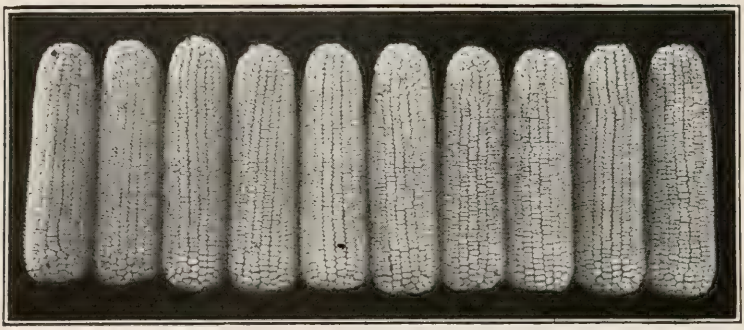


Figure 1. Good ears of Reid's Yellow Dent, a particularly good variety of yellow corn for North Missouri.

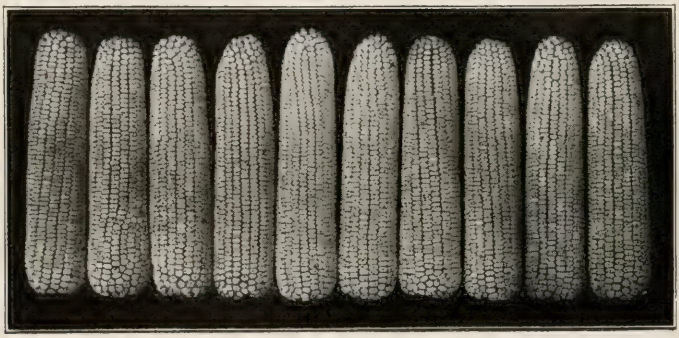


Figure 2. Ears of Boone County White, the variety of white corn preferred by over twice as many co-operators as any other variety.

variety named and recommended by more than nine, and most of them by a far less number. The Leaming corn, which is probably our oldest variety, was named by 9 different states; Boone County White by 4; Champion White Pearl by 4, and Reid's Yellow Dent by 3. No other of the 200 different varieties was recommended by more than 2, and most of them by only one. Thus, it would seem, this example shows more or less specifically that the adaptability of each variety of corn is quite limited. One variety develops best and produces the largest yield of marketable corn under one condition, while another variety will be found best under another.

There are many ways in which yields can be decidedly increased; one of these, of course, would be by the use of commercial fertilizers; another by a more thorough preparation of the seed bed, or by more attention to the conservation of moisture and more thorough cultivation. An increase secured in any of these ways, however, is at a considerable expense, so that the profit is limited. On the other hand, an increased yield secured from a selection of a better variety is clear gain after the seed has been secured; and the increase in yield as great, and often much greater, than by any of these other methods—in some cases one variety yielding over twice as many bushels per acre as another.

Within the last year the question has been coming with ever-increasing frequency, "What is the best variety of corn for me to grow on my farm?" Sometimes this question comes from a farmer living on the rich flat bottoms in Southeast Missouri; again, it comes from a farmer on the lighter, colder upland soils of Northwest Missouri; and, again, from the Ozarks, or from the central west. The question which must be decided is whether or not these men will all be given the same answer. The purpose of co-operative corn testing has been to answer these questions and, if possible, to answer them rightly.

Missouri is a large state, made up of many distinct and differing types of soil, and with a wide range of climatic conditions, so that results secured from a variety test in one part of the State might not be at all representative of other parts. While practically all of the different varieties which gave any promise of usefulness in the State have been tested at the Experiment Station at Columbia, yet one can not know from these tests that the varieties which produce the highest yields here will give highest yields under other conditions.

The plan has been to test these varieties which give the greatest promises of value, on all of the soil types of the State; in every part of the State; in every county in the State. How well this has been accomplished is shown by the accompanying map. Here it is seen that practically every county in the State has in it one or more men testing, in co-operation with the Agricultural College, these different varieties. These men are testing the different varieties of corn on their own soils; on their own farms, so that at the end of the season they may know just what variety will give the largest yield of most marketable corn on their farms. It would seem that a test of this sort would be of practical value to every farmer and to every community. The Department of Agronomy furnished each co-operator with enough seed of the 12 different varieties to plant one-fourth acre each. These were planted side by side, great care being taken that they be placed on soil of equal fertility, the different varieties usually being planted in a few long rows, as this generally gave more uniform soil conditions than shorter blocks. The intention has been to have these varieties planted on soil of only medium fertility, in order that the results would better represent a larger number of farms. As the season advanced each co-operator made careful observations and careful notes on the character of the stalk, leafiness, height, number of days to mature, etc., and when the corn was mature each variety was husked separately and weighed carefully, in order that we should have exact information as to the yielding power of the different varieties. After each co-operator had done this, he was asked to name, in order, which, in his judgment, were the three best varieties. These answers are here tabulated, and you will note the results. You will observe that the Boone County White was preferred by at least twice as many men as was any other one variety; and the Reid's Yellow Dent came second in total preferred values; though a comparison of this chart with the yields secured by the co-operators shows that these two varieties were by no means the highest yielding varieties for the entire State. This, it seems to me, means that there must be considered, beside the total yield of ear corn, the quality of the corn, the size of the ears, and the hardness and roughness of the kernels. All these must be given due consideration.

TABLE SHOWING THE NUMBER OF CO-OPERATORS PREFERRING THE DIFFERENT VARIETIES.

Variety.	First choice.	Second choice.	Third choice.	Total preferred
Boone County White	24	7	6	1530*
Reid's Yellow Dent	10	10	9	980
St. Charles Yellow	4	11	4	610
Commercial White	7	6	4	610
Leaming	4	7	4	490
St. Charles White	3	4	7	410
Johnson County White	1	3	9	320
Hildreth's Yellow Dent	1	5	5	300
Illinois Silver Mine	2	2	6	280
Iowa Silver Mine	2	3	3	250
Hogue's Yellow Dent	2	3	3	250
Legal Tender	1	2	2	150
Cartner	2	0	1	120
His own variety	0	0	1	20

*In figuring this column the value 50 is given for first choice, 30 for second, and 20 for third.

In comparing yields of various varieties for the whole State we find a range of from 38 to 47 bushels. While one might expect a greater difference than this, yet when he considers that these yields represent all these varieties on all the different soil types of the State he must readily see that even this difference is quite remarkable. For while one variety will give the best results under one condition, under other conditions another may stand at the head of the list. In view of this the chart shows very clearly that there are a few varieties which, considering all conditions, give the largest yields of ear corn. Such varieties have a wider range of adaptability than others, also in the list, which give particularly good yields under certain conditions, but under another set of conditions produce a very unsatisfactory yield. Noting the average yield of the entire State, we find that Commercial White heads the list with 47.4 bushels per acre, this being 2 bushels more than any other variety and 9 bushels more than some of those tested. The Boone County White gives the second largest yield with 45.4 bushels per acre, while Reid's Yellow Dent, St. Charles White, St. Charles Yellow and Johnson County White come next in order, very close together. While this data is valuable, it does not defi-

*AVERAGE YIELD OF ALL VARIETIES FOR THE STATE. YEAR 1908.

Commercial White	47.4	Leaming	42.9
Boone County White	45.4	Legal Tender	42.9
Reid's Yellow Dent	44.6	Farmer's Own Variety	41.7
St. Charles White	44.6	Hogue's Yellow Dent	40.5
St. Charles Yellow	44.4	Cartner	39.1
Johnson County White	43.5	Iowa Silver Mine	38.9
Hildreth's Yellow Dent	43.2	Illinois Silver Mine	38

*This table includes more reports than those given in the table as presented Farmers' Week.

*VARIETIES ARRANGED IN ORDER OF YIELD FOR NORTH MISSOURI FOR THE YEAR OF 1909.

Variety.	No. of days to mature.	Quality of corn in per cent.	Yield of ear corn per acre, bushel.
Commercial White	136⅓	74	47.03
Reid's Yellow Dent	120½	81	46.0
Boone County White	127⅔	78	45.86
St. Charles White	128	72	45.72
St. Charles Yellow	128	73	45.5
Legal Tender	122	75	44.98
Johnson County White	128	77	44.37
Leaming	122	82	43.83
Hildreth's Yellow Dent	136	64	43.58
Farmer's Variety	133	78	42.31
Hogue's Yellow Dent	121	74	42.26
Iowa Silver Mine	120	75	39.56
Cartner	129	71	39.42
Illinois Silver Mine	121	75	39.26

*This table includes more reports than those given in table as presented Farmers' Week.

*VARIETIES ARRANGED IN ORDER OF YIELD FOR SOUTH MISSOURI FOR THE YEAR OF 1909.

Varieties.	No. of days to mature.	Quality of corn in per cent.	Yield of ear corn per acre, bushel.
Commercial White	132	77.5	48.6
Boone County White	121	82.3	44.2
Hildreth's Yellow Dent	132	71.2	42.5
St. Charles White	126	75.8	42.1
Johnson County White	126	75.2	41.5
St. Charles Yellow	125	81.6	41.4
Leaming	120	75.9	40.5
Reid's Yellow Dent	118	71.1	38.8
Farmer's Variety	135	88.5	38.7
Cartner	123	69.4	38.6
Silver Mine (Iowa)	118	71.7	37.3
Legal Tender	123	69.2	36.3
Hogue's Yellow Dent	121	67.5	36.2
Illinois Silver Mine	116	68.3	34.7

*This table includes more reports than those given in table as presented Farmers' Week.

nitely answer the question as to which is the best variety for the man in South Missouri and the one in North Missouri, each of whom encounters different soil and climatic conditions.

In order to come a little nearer to solving the problem we have divided the State into 2 sections which, for convenience, we shall call North Missouri and South Missouri; the dividing line lying south of Bates, Henry, Pettis and Cooper counties to the river, then following it to the eastern boundary of the State. The conditions in North Missouri will be very much more similar and uniform than for the whole State, and the same, of course, is equally true for South Missouri.

A comparison of yields of the various varieties in South Missouri with those in North Missouri discloses some very striking differences, and also, some striking similarities. First, it will be seen that Commercial White stands at the head of the list, both in North and South Missouri; the yield in North Missouri being 47.03 bushels and in South Missouri 48.06. This again indicates that this variety has a very wide range of adaptability, and is a very useful and valuable one for the State. But now, to note the second highest yielding variety in North Missouri, we find it to be Reid's Yellow Dent, with a yield of 46.8 bushels; though in South Missouri we find Reid's Yellow Dent eighth in order of yield, with only 38.8 bushels. We, therefore, conclude that Reid's Yellow Dent is particularly well adapted to the rolling prairies of North Missouri, while in South Missouri, averaging all conditions, it is not so well suited, and its range of usefulness throughout the State is, no doubt, more or less limited. However, we have in South Missouri a yellow variety which, perhaps, may supplant Reid's Yellow Dent for those who want a yellow corn. I refer to Hildreth's Yellow Dent, which gave the third largest yield in South Missouri, while in North Missouri it ranks ninth in order of yield. Probably that variety of corn most widely known in the State and of all improved varieties most widely grown is the Boone County White. In South Missouri it stands second in order of yield, coming next to Commercial White, and in North Missouri it is third, the Reid's Yellow Dent outyielding it a little for this year. For the past season the St. Charles White seems about equally well adapted to both North and South Missouri, which is also true of Johnson County White and Leaming.

Now, while these results are well worth the careful consideration of every man producing corn, yet we should not give too much emphasis to this one year's results. This data clearly shows that the different varieties are best adapted to certain well defined conditions, and that with the conditions met with the past season certain varieties very much outyielded certain other varieties. Though it is entirely possible that if these same varieties were tested next year (as we expect they will be) the order of yield for some of the varieties may be very materially changed. In fact, former experience has shown us that under different seasonal conditions we may expect considerable variation. And most of the men who are carrying on this co-operative work no doubt recognize this fact, for some of them have made this co-operative test for three or four years, and consequently know pretty thoroughly which variety in a series of years will give them the highest yield, and will, therefore, be the most profitable for them to grow.

We must no longer be satisfied with just growing corn—white corn or yellow corn. We can not afford it. It has been demonstrated that some varieties very much outyield others, and that the cost of producing these high yielding varieties is no greater than that of less desirable ones.

We can safely conclude from this work that Boone County White, Commercial White and St. Charles White, for seasons like the last one, are of the highest yielding sorts. That Reid's Yellow Dent is a yellow variety particularly adapted to North Missouri, while St. Charles Yellow and Hildreth's Yellow Dent are better for South Missouri conditions.

SUMMARY FOR THE YEARS 1906, 1907 AND 1908.

It has already been said that one must not place too much emphasis on one year's results. They represent a comparative test of a number of varieties under an existing set of seasonal conditions. With other seasonal conditions we might expect to find other varieties with different adaptabilities doing best and giving the largest yields. This has been true in some cases in this coöperative work in the variety tests of corn. For this reason we here add a summary of the variety tests for the years 1906, 1907 and 1908.

In comparing the yields of the various varieties for the past three years we find, in general, the same varieties giving the largest yields and the same ones giving the smaller yields as in the test for the year 1908 alone. There are some marked exceptions to this, however. In noting the place in which Reid's Yellow Dent stands, in the average for the whole of the three years, we find it to be below Leaming, St. Charles White and Legal Tender, while for 1908 alone it stood third in yield. This is, of course, a very great difference and shows that while the Reid's Yellow Dent was well adapted to North Missouri under the conditions existing the last year, in a number of years so high a yield could not be expected. While this variety seems not to be particularly high yielding in an average number of years, yet we note, in the table giving the number of men preferring the different varieties, that it stands next to the top, showing that it has very good characteristics, which makes it desirable, perhaps, aside from yield; the actual yield of bushels per acre, however, is of course the most important factor. One other variety which is worthy of note is the Legal Tender, which in the average for the past three years stands fourth in order, while in 1908 it stood ninth.

Comparing the yields of North Missouri for the past three years with that of the last season we find Commercial White, Boone County White and St. Charles White at the head of the list in both cases. St. Charles Yellow, which gave very satisfactory yields in the year 1908, it will be observed gave very unsatisfactory yields averaging the three years. This is probably the greatest difference to be noted in North Missouri.

In South Missouri again we find Commercial White and Boone County White at the head of the list in both cases; also Hildreth's Yellow Dent stands up well for the average of the last three years as well as the past season. One very marked exception in South Missouri is the Cartner variety. For the past season it will be noted that it was tenth in yield while averaging the last three years it stands fourth in order of yield in South Missouri.

In comparing the tests for the years 1906, 1907 and 1908 with the past season we can not but be impressed with the fact that each variety is particularly adapted to a certain set of conditions and the variety which does best one season may not do as well as some other variety with other seasonal conditions another year. The Reid's Yellow Dent the past season compared with the average of three years, also the Cartner brings this point out very strongly. After this has been said, however, one should again consider the fact that taking the yield of all of the different years together there are two or three varieties which have been shown to be very high yielding ones under all conditions whether in North Missouri or South Missouri or with varying seasonal conditions. These varieties would, of course, be the Commercial White, Boone County White and St. Charles White. Most of the other varieties seem to be influenced more or less largely by seasonal conditions, climatic and soil differences.

AVERAGE YIELD IN BUSHELS PER ACRE FOR THE STATE FOR THE YEARS 1906, 1907 AND 1908.

Variety.	1906.	1907.	1908.	Av. yield.
Commercial White	*49.9	56.6	47.4	51.3
Boone County White	49.2	55.88	45.4	50.16
Hildreth's Yellow Dent	*47.39	53.8	43.2	48.13
Legal Tender	47.6	49.68	42.9	46.72
St. Charles White	45.9	48 27	44.6	46.28
Leaming	45.1	50.2	42.9	46.0
Reid's Yellow Dent	43.1	50.7	44.0	45.9
Hogue's Yellow Dent	44.7	48.96	40.5	44.72
Johnson County White	39.9	50.6	43.5	44.6
Cartner	*43.6	49.56	39.1	44.1
St. Charles Yellow	36.2	49.39	44.4	43.33
Iowa Silver Mine	43.6	45.0	38.9	42.5

*Yields calculated from 1907

AVERAGE YIELDS IN BUSHELS PER ACRE FOR NORTH MISSOURI FOR THE YEARS 1906, 1907 AND 1908.

Variety.	1906.	1907.	1908.	Av. yield.
Commercial White	*51.5	64.6	47.03	54.37
Boone County White	51.5	65.6	45.8	54.32
St. Charles White	52.2	61.7	45.7	53.2
Legal Tender	49.7	59.0	44.98	51.22
Leaming	50.1	59.0	43.8	50.97
Reid's Yellow Dent	46.2	59.6	46.0	50.6
Johnson County White	45.0	59.1	44.3	49.49
Hildreth's Yellow Dent	*46.2	57.9	43.5	49.22
Hogue's Yellow Dent	46.0	58.2	42.26	48.88
St. Charles Yellow	39.9	58.0	45.5	47.8
Cartner	44.5	55.8	39.42	46.5
Iowa Silver Mine	42.5	49.6	39.56	43.88

*Yields calculated from 1907.

AVERAGE YIELDS IN BUSHELS PER ACRE FOR SOUTH MISSOURI FOR THE YEARS 1906, 1907 AND 1908.

Variety.	1906.	1907.	1908.	Av. yield
Commercial White	....	39.5	48.6	44.03
Boone County White	40.3	46.5	44.2	43.6
Hildreth's Yellow Dent	....	42.9	42.5	42.7
Cartner	....	45.1	38.6	41.8
Leaming	39.6	44.5	40.5	41.5
St. Charles White	44.5	37.5	42.1	41.36
Johnson County White	39.6	42.5	41.5	41.20
Reid's Yellow Dent	36.1	42.1	38.8	39.0
Legal Tender	40.0	39.7	36.3	38.6
St. Charles Yellow	33.4	40.8	41.4	38.5
Hogue's Yellow Dent	37.2	37.7	36.2	37.0
Iowa Silver Mine	....	33.88	37.3	35.59

WHAT ARE WE TO DO WITH OUR SOILS?

(By Hon. Milton Whitney, Chief Bureau of Soils, United States Department of Agriculture.)

I have heard with interest what the State of Missouri is doing in the direction of soil investigations and surveys. The soil, with water, is the one great inexhaustible asset of the nation. If the forests are not kept up, if the coal and iron are exhausted, we have the *soil* to depend on to furnish food, clothing, heat and habitation for the nation. It is the greatest of all our resources, and, fortunately, it seems to be inexhaustible.

At the recent Conference of Governors at the White House to consider the state of our natural resources, the question of the deterioration of the soil was discussed. It will not be possible for me, in the limited time at my disposal, to follow out all the lines of thought that were presented as a result of the discussion at the Conference and subsequently by the commission that was appointed by the President.

I think, however, that you will be interested in the main results of such investigations; that is, that throughout all history, so far as records go, the soils of the world have never yielded larger crops than they are yielding now. We find through research in the historic works of foreign countries that in Germany, so far as statistics taken from the old family records of the baronial estates can be relied upon, the yields three hundred years ago were about one-third as large as the yields today. Taking the records of the countries of the world who have by agreement adopted the same general methods of statistical research, we find that the records for the past thirty or forty years (which have been accurately obtained and recorded) show that the yields of the crops of Europe, on soils that have been cultivated for at least a thousand years—that the yields during the past fifteen, twenty, thirty, forty years have increased more rapidly than they have on the newer soils of the United States.

ARE OUR SOILS WEARING OUT.

There is a general impression that the soils of the United States, or particular portions of the United States, are wearing out, that they are becoming exhausted, that we are having now abandoned farms. One of the results of the investigations into this important question—for it is a question of the utmost importance to the nation, the question as to whether the soils are wearing out and how long they can be expected to last with an increasing population—is that we find that so far as statistics can be relied upon our crop yields are increasing, that on the average our farms are better tilled, we are paying more attention to seed selection, to crop adaptation, and to fertilization, with the result that we are getting more from our soils than we were forty years ago. Forty years! Our records have been kept for forty years—that is almost as long as the life of a large part of the people of the United States. Many of you here can doubtless remember the settlement of this part of the country. Many of you will remember when the prairies were considered useless for agricultural purposes—they are now producing magnificent yields of corn. But the impression has gone out that our virgin soils are declining in fertility. The fact of the matter is that on the soils of Europe, which have been occupied for agricultural purposes for a thousand years—yes, for two thousand, and for three thousand years, within historic times and with historic data—that the soils of Europe are producing more than the virgin soils of the United States.

Now, we went further than this in the investigation of this question of the permanency of soil fertility. We asked ourselves this reasonable question: If, on the soils of Europe which have been occupied for agricultural purposes for a thousand years, which are yielding more annually per acre than the soils of the United States—if there was a question of an ultimate deterioration and loss of plant food through finite times, the history of the chemistry of the soils of Europe should show the fact to us now so that we could prepare for our future state.

WE ARE PERSONALLY RESPONSIBLE FOR SOIL MAINTENANCE.

We have collected and collated the results of all the soil analyses that have been made so far as they are published in the literature of the world; we have examined particularly the results of the analyses that have been made in the past eighteen years since modern methods of analysis were introduced. We find that there is no significant difference between the chemical composition of the soils of Europe today and the chemical composition of the soils of this new country that we call the United States. There are variations in the composition of our soils, there are variations in the composition of the soils of Europe, but the variation is as great in the one case as in the other; the minimum is as low in the one case as in the other and the maximum with any of the plant food elements is as high in Europe as it is in the newer soils of our own country. What does this mean? It means that we are, each of us, personally responsible for the cultivation and the maintenance of fertility of our own farms. We cannot sit back and shrug our shoulders, as we are inclined to do, and look at the old fields grown up in weeds, and evidently deteriorating, and blame an "unwise Providence." We cannot say, as we have been too prone to say, that the trouble is that the soil has been robbed by our predecessors. We can just as well agree now to face the situation and understand that the fertility of the soil is as permanent and as free to all who own the land as the atmosphere is to all who breathe air. While we can defile the air with our manufacturing plants, while we can impede the ventilation of our rooms and suffer diseases or impairment of our powers by lack of sanitary conditions, so we can abuse our soils and make them run down and fail to produce as they should through lack of attention, through lack of knowledge, through lack of appreciation or through lack of energy, and we have ourselves to blame, either through our ignorance or through our incapacity, when we talk of abandoned soils and impoverished land.

It would be a matter of the utmost interest to me if I had the time to tell you of some of the advances that we are making in the investigations of soils. Up to within twenty-five or thirty years ago, I think, we knew a great deal more about the composition of the sun than we did about the composition of the soil of our own earth. We certainly knew more about the laws of the heavenly bodies than we did about the laws of agriculture, and it is not surprising, for all human knowledge has begun by a study of the far-off, the vague. It comes in in recent years with more mature thought, with more intelligent action, and we now look at things close by; and one of the latest subjects attacked by science is the soil upon which we walk, and still further back than that is a subject of equal importance that we know still less about than we do of the soil, that is common to us all, and that is *water*.

COLOR IN SOIL.

We know almost nothing about the properties of water, and that is a subject which is going to be attacked by scientific methods now before long, as the soil has been attacked within recent years. It is one of the most fascinating subjects of today; of course, it is of great interest to me, as I have pushed myself along in it, and I find that whenever I get a chance to talk about the subject of the soil, the advances that have been made, the knowledge that we have acquired always appeals to anyone who is at all interested in agriculture; but time will not permit the discussion of it this morning, except just briefly to bring up the important points of the soil survey. One of the things that science is attacking is that the color of the soil is to some extent indicative of its fertility and crop adaptation. It is a very simple thing. We see here a red soil and a red subsoil, and next to it a black soil and a black subsoil, and in another field a yellow soil and in another a white soil. We know that they are different, that they are adapted to different crops. We know that if we put the same crop on each of these soils that the plants will function differently; they will grow better on some of them than they will on the others. Now, has the color anything to do with this? The color is probably indicative of a subtle difference—a chemical or biological difference—what you will; but that difference which is indicated by the color shows you the best crops and the best treatment to give your soil as compared with another soil.

Now, science is trying to determine, if possible, what it is in this red soil, what it is in that black soil, apart from the plant food, that makes the plant's activities grow, the something that builds up the system, makes it want to grow and live as we do when we are feeling in first class condition and our digestion is all right.

CHEMISTRY OF THE SOIL.

The chemistry of the soil, as we are working it out today, is not the chemistry of the mineral matters, as Liebig told us. His work was all right so far as it went, but it stopped just short of this: That there is a chemistry of the minerals, and there is a chemistry of the organic properties of the soil; and we are finding now that the chemistry of the soil is running parallel to the chemistry of our human bodies. The soil chemist and the biological chemist for the study of the causes of diseases, are running right together in a parallel line. We are finding the same property in the soil that they are finding in the animals which causes fatigue or exhaustion, and, if carried too far, the death of the organism. We are finding in soils substances that produce sickly or weak plants, that produce plants that are easily subject to disease, just as we find, as a cause of our own ill condition, substances that are injurious to the proper functioning of the body. The subject is of immense importance.

As a result of this investigation, we are beginning to learn the reasons for the special adaptation of soils to particular crops. We are beginning to understand for the first time, as we never would have understood if we had persisted in the lines of soil mineral chemistry, why it is that the pippin will grow better on one kind of soil, that the Winesap is best adapted to another soil, that the varieties of tobacco are grown on their separate and distinct soils; we are beginning to understand now the fact that we have realized, in practice, that our different varieties of grapes, whether for wine or for table use or for grape juice, etc., are adapted to different soils, that they do their best and develop as we want them to on different kinds of soils. These matters we are beginning to understand, and they are forcing us to realize that the first and most important subject of the soil survey is to determine the particular type and distribution of soils so that we can adapt our crops and our varieties of crops to each soil. We have found in the south that the variety of cotton that is adapted to a particular type of bottom land, that in such a location will grow normally and produce a bale of cotton to the acre, if planted on upland out of its environment, goes to pieces, fails to produce the yield of lint that we have a right to expect from the history of its production in the past. We find that the crop that has adapted itself, through selection and breeding, to the uplands, until it will produce a bale of cotton to the acre on what we call a Norfolk sand, goes all to pieces on the uncongenial, unrelated conditions in the soils of the bottom land. That fact has made a difference of $20 an acre for some of the farmers of the south, who are working out this one simple problem of adapting the type of cotton to the particular type of soil which they possess.

WHAT IS THE VALUE OF THE SOIL SURVEY?

The work of the Bureau, throughout the United States, has brought us in touch with so many illustrations of this kind, so many opportunities of adapting a soil to a crop or to a variety of crops, that it would weary you to hear of the number of cases.

In any soil that you take up, in any locality to which you go, the question presents itself—what is the value of the soil survey? Professor Marbut, when any one asks you what is the value of the soil survey, ask them what they are proposing to do with their soils; if they are satisfied with their soils and what they are doing, then the soil survey is of no value. But we have never been less satisfied with all the progress we are making, the farmers of this country have never been less satisfied than they are today with what they are doing with their soils.

Twelve years ago, when Secretary Wilson wrote his first annual report to the President, he gave the value of the farm crops of the United States as three thousand million dollars—three billion dollars. This last month, when he wrote his twelfth annual report, the value of the farm cops of the United States was *eight* billion dollars. That one man has seen the growth of the farm crops of this country in his one administration of twelve years advance from three billion to eight billion dollars. The people are not satisfied. We are doing better and better. We are doing better every year, and each individual to keep up with the procession that he sees, not only in this country but in foreign countries, is less and less satisfied with what he is doing with his soils; and I find that the demand for the soil survey is growing so fast that the Bureau of Soils, with all its resources, is unable to keep up with the work. The Bureau of Soils has surveyed about 400 areas, aggregating about 180,000 square miles; that is larger than Great Britain and Ireland (120,000 square miles), larger than the Empire of Japan, nearly as large as France or Germany. The map here (showing map) shows you the distribution of the work and shows another very interesting thing which, as it stands, seems a very embarrassing thing to me: That the amount of work we have done is still but a small proportion to the amount that will have to be done to make a soil survey of the United States. If Congress, in its wisdom, continues the survey until it covers the United States, and we should decide to complete that portion of the country east of the 100th meridian on a scale of one inch to the mile, and this portion of the country (pointing to the map) on a scale of six inches to the mile, then we have finished about 13 per cent of the area east of the 100th meridian that will have a detailed soil survey. However, while it seems to us who are responsible for the work, that we have done great things in covering so large an area, while we will this year, if the appropriations by Congress permit, cover 40,000 square miles—an area larger than England, on a scale of one inch to the mile, and 100,000 square miles of reconnaissance work in the Great Plains region, there are none of the foreign governments that have undertaken what seems to them so stupendous a work as to make a soil survey of their own territory—a work that this country is doing in a quiet way, and has in the short time that the work has been carried on, surveyed areas equal to or larger than several of the European countries. We compare our country in its financial standing, in its bank reserves, in its foreign commerce, in its battleships, in its agricultural productions, with Great Britain, or France, or Germany; but when we come to the soil survey we find that the area of the United States is not comparable with the size of Great Britain or with Germany, but the whole of Europe, and what we have undertaken to do is to make a soil survey not equal to one of our foreign countries, but equal to all European countries combined. Now, that leads us to think of the possibility of development of this country if we shall produce upon our soils what they are producing in these older settled countries of Europe.

The time will come, if we develop in the future as we have in the past, when the United States will be compared not with one country of Europe, but in its resources, in its wealth, in its agricultural productions, it will be comparable only with the combined strength of all the European countries—it will be comparable only with Europe itself; and the State of Missouri, with its 59,000 square miles, largely an agricultural state, must take its place, must do its part in the development that is going on, that has gone on rapidly and satisfactorily in the past, but that must be helped and encouraged in the future as it has been in the past, and I think the State is to be congratulated that this great university, that we hear of throughout the east as one of the leading institutions of the country, has taken up and is pushing so energetically this question of the soil, its characters, its distribution, and its adaptation to crops, and the cultural methods adapted to the different types; for these questions are important to the State, as to the nation, for in the aggregate they make the nation's wealth and the State's welfare, and it is necessary because of the lack of possible lines of organization, as we have with commerce and with mines and minerals, it is necessary for the State and the nation to help in the development of this, the greatest resource of them all, and the most permanent resource. And further, the national government, so far as I can speak through the limited powers given me by Congress from year to year in our annual appropriation bill, will be only too glad to co-operate with the State of Missouri and try and arrange a definite and consistent basis of work, so that the work can be concentrated and finished sooner than either could finish it alone. The many demands that are made on the National Bureau of Soils, from all parts of the State, from all parts of the country, make it imperative that we give our attention to different places, that we scatter our work to satisfy the demands of the different states; but the time is coming, if Congress is willing, for me to take the position that where the state appropriates some money to carry on this soil survey and soil investigations, that the government will meet them with an equal allotment from our appropriations, and with the national forces and the state forces working together, we can evolve a plan, a continuous plan, that will enable us to get this information for a state, such as Missouri, in eight or ten years, instead of leaving it to the development of the general national policy which, while satisfactory to the nation as a whole, does not give an adequate service to any particular state. And this is one of the messages I have brought to Missouri: That we in Washington are glad to see that you are doing so much for yourselves, and would be glad to see you do more. We would be glad to see your Legislature make an appropriation of eight or ten thousand dollars a year, that we would, out of our funds derived from Congress, be glad to put in an equal amount and, by doubling our forces, maintain a constant service in the State of Missouri, so that the classification and survey of the State can be finished in eight or ten years; and that is what we would like to see done because we are interested in it from a national standpoint as well as from the standpoint of the State of Missouri.

DISCUSSION.

Q. When you speak of Secretary Wilson's report showing that the value of farm crops advanced from $3,000,000,000 to $8,000,000,000, do you mean that the farm crops alone advanced that much, or do you mean live stock and other things?

A. It means both—the total value of live stock and farm crops.

Q. I would like to ask whether the yield per acre has very materially increased in the last twelve years.

A. The records show that for the past forty years, if you divide the period into four periods of ten years each, that the first decade and the last decade have been rather high, have given rather high yields, and the two intermediate have been rather low, so that there is apparently a falling off and then a rise for the past thirty years; but as a matter of fact, in statistics of this kind, forty years is too short a time to eliminate seasonal differences. For example, in the past ten years California has seen two of the lowest crops on record, and the last year of the period they got the third highest yield on record. Now, when the difference between the minimum and maximum yield in a ten-year period is greater than the average for the whole period, the average does not mean much; but so far as we can say safely the indications are that there has been a rise in yield of crops during the past forty years, but it has not been very marked.

THE MISSOURI SOIL SURVEY.

(C. F. Marbut, in charge Missouri Soil Survey.)

A soil survey is a fundamental investigation of the nature, origin, distribution, relation, and utilization of the greatest natural resource entrusted to the use and care of man by the Creator. It is at once a scientific and economic organization. It should concern itself with the soil from the point of view of pure science as well as from the point of view of its practical value to man. The two relations are inseparable. The study of the practical utilization of the soil can be carried on with intelligence only when it is thoroughly known as to its character, composition, distribution, location, and other relations. The latter characters are the more fundamental and must be determined before any important progress can be made in the investigations of the former. The determination of the best method of soil management can often be made by field study alone—by mere field observation of the action or response of a soil to the many different kinds of treatment it receives at the hands of farmers. Even where experimental methods are used for the purpose of controlling the conditions, observational results can not safely be dispensed with. Experiments, however, cannot be conducted, by the state at least, on every tract of land. The determination of the best localities for experiments in soil management is therefore wholly a question of the knowledge of the soil in its physical, chemical, organic, geologic and geographic relations. The purely practical side of all soil survey work, therefore, may take the form of observational determination of the soils, capacities and capabilities under ordinary field conditions and experimental determination, both of them being based on a knowledge of the nature of the soil itself. A soil survey includes the fundamental work of determining the nature of soils and their distribution and the practical work, based on the latter, of determining the most permanently profitable method of soil management.

Advance in civilization is invariably accompanied by a great broadening of the range of man's requirements for physical comforts. Each and all of these must be supplied from the natural resources of the earth so that the advance of civilization increases greatly the demands made on the earth by man. It is probably not far wrong to say that without the possibility of supplying these increased requirements for comfort civilization could not advance. While true civilization is accompanied by an improvement of man's moral and spiritual nature, yet moral and spiritual advancement is conditioned absolutely on a degree of physical comfort. The material basis of civilization must be acquired before the spiritual improvement can take place.

The country with slender natural resources stands always at a serious disadvantage in the upward struggle for social, spiritual and intellectual betterment. The country that has been blessed with abundant natural resources, but has allowed them to be exhausted by use and abuse, is not only at a disadvantage, but its rulers have committed a crime against nature and their own people in allowing such exhaustion to take place. It is, moreover, one of the most imperative duties of the authorities in any country to take measures that will insure the preservation, so far as that is consistent with the daily requirements of the people of the country, of its natural resources. It is as much a duty to make use of the material resources of the earth as it is to preserve them. A balance between no utilization at all on the one hand and prodigal waste on the other must be maintained. This is not to be accomplished by deprivation. Probably no land has ever been seriously impaired in natural resources through the legitimate though abundant use of man. It has occurred in particular instances, no doubt, but waste has occurred more as the result of lack of care and the failure to take precautions against loss through the operation of natural forces.

The invididual citizen is, as a rule, not vitally interested in the preservation of natural resources. His life is short and his interests are immediate and personal. He does not concern himself to a great extent with the problem of the future of mankind or its means of maintaining an existence upon the earth. Human society, on the other hand, is, in some form, perpetual. It lives indefinitely and its demand for physical maintenance in the future will be as great as in the past if an equal degree of civilization be maintained. While the individual, therefore, may not feel a vital interest in the preservation and proper use of the material basis of human civilization, human society and its personification, human government, should and must be vitally interested in it. It is unquestionably a legitimate function of the government of every civilized country to take measures toward insuring the permanence of its existence. One of the most evident means of doing so is to determine the nature and amount of its resources and on this as a basis determine the best means of insuring their preservation.

This has long been a recognized function of governments with however limited application. For more than half a century the determination of the mineral resources of many of the states of this country has been a recognized function of the state governments. Our own national government and practically every other civilized government in the world has done the same thing. Missouri has spent within the last sixty years more than half a million dollars for geological and mineralogical investigation. It has been only within the last decade or two that any attention has been paid similar investigations of soils, the source of man's most important income. More or less spasmodic work on the nature and composition of certain soils was done many years ago, but the beginning of systematic investigation of soils in this country is recent. While a good deal of data has been accumulated on many different kinds of soils, yet the actual field relations of those soils, their geologic and geographic distribution (especially the latter), are still, to a great extent, unknown.

The 43rd General Assembly of Missouri included in its appropriations to the Missouri Agricultural Experiment Station a small amount of money for the purpose of starting soil survey work in this State. The survey was organized in April, 1905, by the Board of Curators. It was placed under the general direction of the Director of the Experiment Station and the work planned under the following three heads. (1) The Field Division; (2) The Chemical Division; (3) The Soil Experiment Division. The work of the first was to cover the differentiation and mapping of the various soils as they occur in the State, to take samples of each type for analytical purpose, determine the physical character of each soil by means of physical analysis and to prepare the reports on the general character and distribution of the soils.

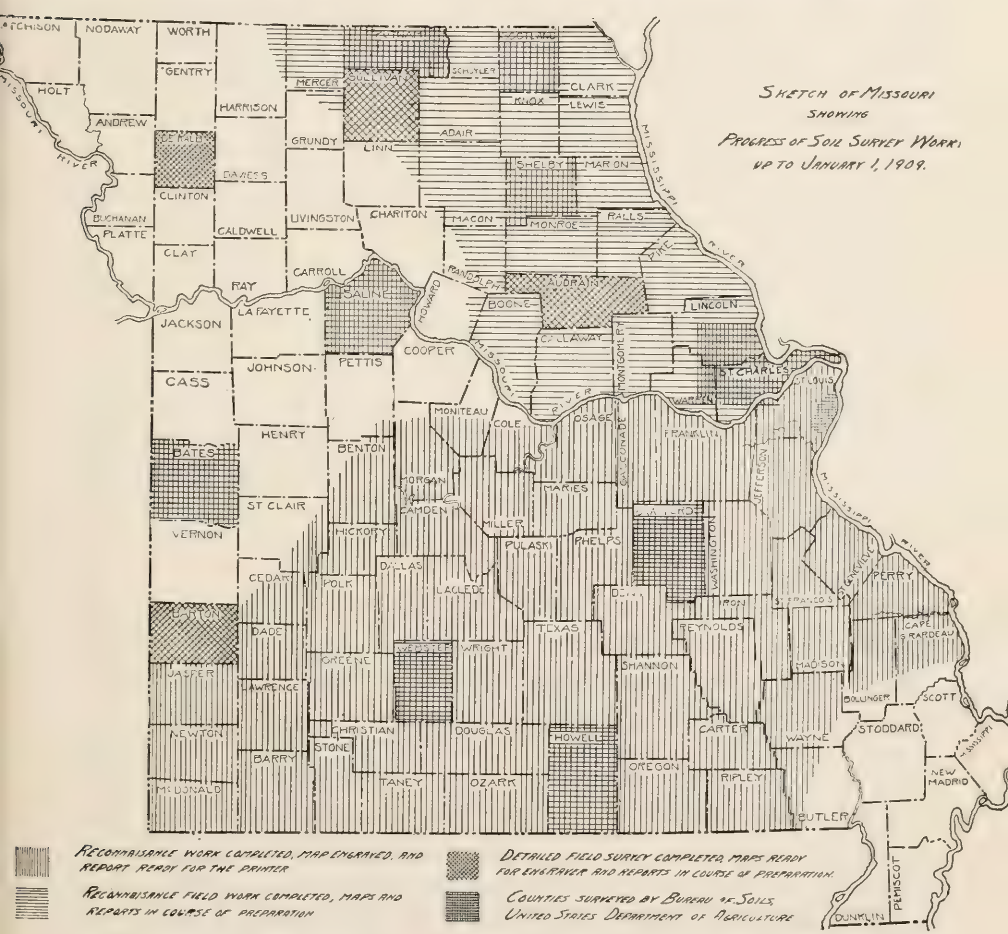
The work of the second division was to consist of the determination of the chemical composition of the soil samples collected by the first division and to analyze and discuss the results.

The work of the third division was to include all the work connected with the determination, by the growth of various crops on the several soil types, of the best methods of handling the various soils under actual field conditions. It was at first thought that the study of actual agricultural conditions in the areas surveyed by the field division should be carried on by the second division, but that has been found impracticable, since the same men must do both classes of work. They should be under the direction, however, of only one man, in order to avoid confusion and hesitation among the survey corps.

As originally planned, the soil survey was an organization with three main departments. In the actual carrying on of the work it is gradually splitting into two organizations: A Soil Survey with a field division and a chemical division, and a Bureau of Crop Experimentation. In the following description of the work already accomplished by the Soil Survey, the meaning of the latter expression is understood. The work of the soil survey proper, as now understood, includes the identification of the various soil types in the field, and the mapping of their distribution, the study of existing agricultural conditions in the areas studied, and the determination of the physical and chemical composition of the various soils. By far the greater part of all the work is the identification, differentiation, and mapping of the soils in the field. The field work of the survey is carried on with two degrees of accuracy and detail. A particular region, usually one of the main physical regions of the State, like the southeastern lowlands, the Ozark regions, etc., is gone over first in a rapid survey for the purpose of determining the general character of its soils and for grouping them into their groups according to their origin or some other relation. This work is done rapidly and the results are intended to be used for purposes of general information about the region and as a guide for future work. General soil maps are prepared for the regions studied. They are published with an accompanying report, which describes the main soil groups and the general agricultural conditions as well as offers suggestions for the treatment of the various soils. We designate this work as *reconnaissance work.*

The other character of field work is detailed work. An area, usually a county, is taken up and mapped in great detail. Every type of soil in the county is identified and its distribution determined accurately. An attempt is made to determine the character of the soil in every ten-acre area in the county. Samples, usually several, from each soil type, are collected for study in the laboratories of the survey. A county map will be prepared and published, showing the distribution and area of all the soils of the county. It will be accompanied by a report describing the soils and agricultural conditions and giving practical suggestions for treating the soils. We designate this as *detailed work.*

The progress of the two grades of field work that had been reached up to January 1, 1909, is shown on the accompanying map. The Ozark region of the State was covered by the Reconnaisance work in the summers of 1905 and 1906. The general map was prepared in 1908, and the report on the region was about ready for the printer January 1, 1909. Reconnaisance field work was begun in North-central and Northeastern Missouri in 1907, and continued in 1908 as far as our small appropriation would allow. The field work was just about completed in 1908, and the general report is in course of preparation. Some Reconnaisance field work has been done in the prairie region of Southwestern Missouri, and a few days spent in Northwestern Missouri, and also in the southeastern lowlands, though these latter two regions are practically untouched. Very little Reconnaisance work was done in the summer of 1908, on account of lack of funds for field expenses.


Sketch of Missouri
showing
Progress of Soil Survey Work
up to January 1, 1909.
Reconnaisance work completed, map engraved, and report ready for the printer
Reconnaisance field work completed, maps and reports in course of preparation
Detailed field survey completed, maps ready for engraver and reports in course of preparation.
Counties surveyed by Bureau of Soils, United States Department of Agriculture
Nodaway
Worth
Gentry
Holt
Andrew
Mercer
Sullivan
Schuyler
Clark
Knox
Lewis
Harrison
Adair
Grundy
Linn
De Kalb
Daviess
Shelby
Marion
Clinton
Buchanan
Platte
Clay
Caldwell
Livingston
Chariton
Macon
Monroe
Ralls
Pike
Carroll
Ray
Randolph
Audrain
Saline
Howard
Boone
Lincoln
Jackson
La Fayette
Callaway
Montgomery
St Charles
St Louis
Warren
Cooper
Pettis
Johnson
Cass
Moniteau
Cole
Osage
Franklin
Henry
Benton
Bates
Morgan
Maries
Gasconade
Jefferson
St Clair
Camden
Miller
Vernon
Hickory
Pulaski
Phelps
Washington
Cedar
Dallas
Polk
Laclede
Iron
St Francois
Ste Genevieve
Perry
Barton
Dade
Texas
Reynolds
Cape Girardeau
Webster
Wright
Greene
Shannon
Madison
Jasper
Lawrence
Bollinger
Scott
Christian
Douglas
Howell
Carter
Stoddard
Newton
Stone
Wayne
Barry
Oregon
Ripley
New Madrid
Mc Donald
Taney
Ozark
Butler
Dunklin
Pemiscot
Missouri River
Mississippi River

In detailed work, four counties have been covered: They are

Barton, Audrain, Sullivan and DeKalb. Barton and Audrain were completed in the field season of 1907, though Barton was begun in 1906. Sullivan was begun in 1907 and completed in 1909. DeKalb was begun and completed in 1908. The soil maps of all of these except DeKalb are ready for the engraver, and the data for the reports has been collected, though the reports have not yet been written.

The result of this work shows great variation of detail in the soils of the different parts of the State. In Audrain county, for example, large areas of country are underlaid with the same kind of soil. In the whole county there are only three or four main upland soils. In Barton county, on the other hand, there are no areas of more than a very few square miles with a uniform soil. There are also many different kinds of upland soils. The soil map of Audrain county, therefore, is simple, while that of Barton is complex.

This amount of work has been accomplished at an expenditure of about $10,000. The planning and supervision of the work is done by the regular Experiment Station staff, and nothing is paid these men in the way of salaries for soil survey work. The expense of the survey, therefore, consists of the salaries and field expenses of the field men and the field expenses that are incurred in supervision. In addition to this is the expense of publication of the reports and incidental expenses of supplies, instruments and other field equipment.

Up to the close of 1908, this work was done by the experiment station wholly, and appropriations made for that purpose by the State Legislature. The Station got no aid in soil survey work from any other source. Soil survey work of an intermittent character has been done in Missouri by the United States Bureau of Soils. Their work consisted only of detailed work with a county as a unit, but the detail to which they have carried it has not been so great as that of the detailed work done by the Missouri survey. The general plan of their detailed work, however, and the end sought, was much the same as that of our own detailed work. In the past ten years they have covered some eight or ten counties. While the Missouri survey has not worked any of the counties that have already been worked by the Bureau, yet it would be necessary at some time in the future to do this, or else have a resulting soil map of the State, part of which was done under the direction of one institution and the rest under that of another. Such a result could hardly be satisfactory. The resurvey of the Bureau's work by the Missouri station would also be to a very great extent a waste of money. To avoid either of these results the Missouri Station approached the Bureau of Soils with a plan of co-operation in soil work in Missouri in January. The plan was accepted, and has been officially agreed upon by the directors of the Missouri Agricultural Experiment Station and Soil Survey and by the Secretary of Agriculture and the Chief of the Bureau of Soils. By this plan of co-operation the Missouri station is given general charge of all the soil survey work in Missouri, the Director of the Missouri Survey being made Special Agent also, of the Bureau of Soils. The Bureau of Soils agrees to furnish and pay the salaries of half the field men, the Missouri Station the other half. The field expenses of the survey parties are to be shared equally by the two organizations. The Bureau agrees also to pay for the engraving of all maps, except those to which the Missouri Station may desire some extra data added, and to pay for the typesetting of all reports. The Bureau agrees also to pay all expenses of supervision.

By this plan of work the Missouri Station will be able to do the work according to its own plans, which will be based on the intimate knowledge of the needs of the various parts of the State possessed by the Experiment Station officers, and the State will be required to pay less than half the total cost of the work.

A TWELVE-ACRE FARM.

(Hon. Matt. W. Hall, Warden Missouri State Penitentiary.)

I will tell you what I have accomplished with twelve acres of land in Jefferson City, owned by the Missouri penitentiary. In 1905, when I took charge of the penitentiary, I found there a small tract of land owned by the State. There were about twelve acres of land that could be cultivated, if you could prevent its washing off. This entire tract of land was rented, with a good house and barn, for $350 a year. In the fall of 1905, as soon as the man who had it rented, got his crop out of the way, I began to fertilize it by hauling all the manure that I could get about Jefferson City, and distribute it over this piece of land. The twelve acres of ground I decided to put into a garden. The first year I planted it in various garden truck, and raised $1,200 worth of vegetables, aiming to estimate their value at the current wholesale prices from time to time. As soon as I got some of the early vegetables off, I sowed all of it that I could in cowpeas. They grew up, standing two feet high, and in September I turned the whole crop under and manured it again that winter. The next year I planted it in vegetables, and I gathered off of it and sent to the provision store of the Missouri penitentiary $1,800 worth of vegetables. I continued the same process the following year; and what I did during the year 1908 is almost an incredible story. If I had not done this myself, I would be inclined to think that the story I am going to tell you was "fishy;" but these vegetables have been gathered, and have gone into the dining-room, and I will now proceed to give you the proceeds of that garden for the year 1908. I hope that you, gentlemen, will not be misled by anything which I may say here, because the first essential thing that will enable a man to succeed on a garden of this kind is to have a *market*. We have always heard that the man was farthest from the market who had nothing to sell; but if a man has got plenty of stuff to sell he needs a market, and must have it, and when in this country we get rapid and safe transportation and a system of good country roads, then we are going to prove a great blessing to the people of our great cities, and the people of our great cities are going to prove a blessing to us because there is so much land and so much opportunity in this country to produce fine vegetables, fine fruits, and everything in fact that tends to make mankind happy, that when we can be brought close enough together, why then both city and county will profit thereby. The people in the towns and cities of Missouri have to pay too much for many farm crops. We want good roads, quick transportation, so that every farmer in this State can get to the great cities with his commodities.

In the year 1908, we gathered and fed the prisoners 9,040 green onions at $6 a thousand, making $542.40; we gathered off of this same garden 45 boxes of onions, at $1 per box. (Each of those boxes held 1½ bushels.) The green onion that I first referred to is known as the winter onion, the one that stays in the ground all winter. It is the easiest thing raised that I know of; it will multiply as rapidly as buckbrush if you will give it the chance. We gathered 32 bushels of yellow onions, at 75 cents a bushel; that onion was raised from seed. We gathered 55 bushels of German ———onions, at 75 cents, making $41.25. We gathered 88 bushels of Red Globe onions, at $1 per bushel; 981 bushels of tomatoes, at 75 cents a bushel; we raised and sent out of that garden 70,120 pounds of cabbage at $1 a hundred; we raised 185 bushels of lettuce, at 25 cents a bushel; we gathered and fed 13 wagon loads of pie-plant, with 14,000 stalks in each load, making $260; we gathered 250 bushels of green beans (the ordinary snap-bean), at 50 cents a bushel. And I want to say that if I could have had three good heavy showers of rain, which I did *not* get, I would have raised 600 bushels of those beans, because I gathered this 250 bushels and only got the beans matured from the first blooming. We gathered 162 bushels of sweet potatoes, at 75 cents; 178 bushels of early Irish potatoes (which I set at 80 cents a bushel, and I bought some the very same time, which cost me $1.10 a bushel; so you will see that I have tried to keep these figures within the range of wholesale prices). Therefore, I find that aside from the rental of the two pastures, I raised on these twelve acres of land fresh vegetables to the amount of $2,966.75; and there are millions of acres of land in Missouri that will do better even than that.

Now, of course, I am from Saline county; my home and farm are there. I am temporarily in Jefferson City, and everybody thinks that Cole county is one of the poorest counties in the State for agriculture. There is a great deal of poor land in Cole county, but this particular spot of land on which I raise these vegetables, is as fine as any piece of land that you can find in any part of this State. It is a rich, yellow, sandy loam, and when properly cultivated and properly seeded, it is, I think, the best piece of vegetable land that I ever saw in my life.

ONE METHOD OF HELPING THE FARM BOY.

(F. H. Crowell, Butler, Missouri.)

When we held this Farmers' Convention two years ago we had with us a gentleman by the name of Grout, from Illinois, who gave us a description of his Farm Boys' Encampment. I was very much impressed with his remarks, and after he left the platform I took occasion to interview him as to his method of holding encampments. It did not seem wise to me at that time to put that plan into operation—I did not think we were ready for it. But I went to work to try to get some boys from Bates county to come up here to Columbia and get in touch with the Agricultural College. We hold a county fair in our county, and I got some of the bankers interested in my plan and got them to offer premiums enabling the boy or young man who showed the best corn at our county fair to come here to Columbia and enter the two months short course. The young man who won came up here and took the course and made a good record. Another bank in our town did not want to be left out on this, so I told them they could send some boys up here for Farmers' Week; they did so, and the boys went home fully enthusiastic over the new methods of agriculture.

THE FARM BOYS' ENCAMPMENT.

Last year when I went home from this convention, I had a plan in my mind which I discussed with the banks and with the farmers, and in which they became very much interested. I wanted to hold a Farm Boys' Encampment, but as it costs considerable money to hold one of these encampments, I began to look around about the financial end of it. We had a banker in our town who had sent a boy here to the Agricultural College, and when I explained the proposition to him, he said that it looked good. He took it up with the Board of Directors, who were all farmers, and they all fell into line, and we began to get ready for the Encampment. After the bankers had promised me that they would finance the plan, I had to hunt around for a place to hold the encampment, and one day as I stepped out on the sidewalk I saw my friend Thompson and I said to him: "I have got the bank to put up the money for the encampment, now, but where can we hold it?" "Why," he said, "you can hold it right on my farm." I saw that that was a fine place to hold the encampment, as all of this man's stock was thoroughbred, everything on his farm was thoroughbred.

We have in our town a company of State militia. They thought now it would be an excellent plan if they took their men out to camp for several days before they went out to Riley to get some instructions—and so they did that; the company went out to camp on Mr. Thompson's farm exactly where we wanted to hold our boys' encampment. You can see the bearing it had on the encampment, but of course we impressed on the officers not to work their boys too hard—two or three days would be enough, and we would not need the tents until Thursday; and so on Thursday morning we took possession. We had the camp in a beautiful place, with everything laid out in military precision, and we had all the paraphernalia of the militia for going into camp. We had three colored cooks and a commissary of the company, so that everything was carried on in military style. When the boys arrived that morning, we formed them into companies; each township in a company by itself, and we thought best to elect a captain for each company so that he would be responsible for the presence of the boys at the lectures and for their conduct while in camp; and I want to tell you men right now that in all my experience I have never seen a better behaved, more orderly lot of boys than we had.

We had a bugler from the militia who called the boys together for meals. The boys marched to their meals assembled in companies. Each township, as far as possible, was given a tent to itself. The tents were big and roomy, holding about twenty-five boys each. The biggest representation from a township was from Summit, from which thirty-five boys came; and I will say that the young man who took the short course here last winter was instrumental, with the help of two or three of his friends, in bringing in that large number from Summit township. There were 268 boys registered, and not a boy within the corporate limits of Butler was allowed to register—they were all farm boys. A school teacher in the northeastern township took his whole school (fourteen boys) and loaded them up in a wagon and brought them to the encampment for the whole three days. That shows what an influence the teachers throughout the country districts can have for the good of agriculture.

When the mess call was sounded, we issued each boy, after he had registered, a tin cup, a knife, fork, and spoon, and told him to look out for them, which he did. The companies were arranged in military style at a long table, and each boy was given his food on a wooden plate (those plates don't cost very much and are extremely handy in camp life) and then went to his tent and ate his meal. If he wanted more food, he went to the table again, and if he had all he wanted he took his plate to the cook's tent and it was burned, which was quite an idea in a sanitary way. Then the boys had time to play games. One method we had of punishing them if they did not behave in strict military style was to throw them up in a blanket.

When the bugle sounded, they all came to the big assembly tent, which seated about 800, and were instructed in different lines of farming. The encampment lasted three days and the boys received a great deal of instruction.

Mr. Jordan was there and talked to the boys on soils and corn and farm life in general; Mr. King was there and gave the boys instructions in judging horses and cattle and hogs and sheep. As the cattle and stock of all kinds on the farm where we were camping were purebred, we had good stock to judge. Mr. Chandler was there to talk on horticulture. The time was all occupied from morning to night, and the boys were much interested. We did not work them too hard, but mixed in a little fun as we went along.

On Friday night the bank invited all the boys to come down town to the show and paid their expenses, and the boys behaved beautifully.

EVERYBODY'S DAY.

On Saturday we invited everybody to come to the encampment—that was Everybody's Day. We had a big crowd and a grand picnic. We served dinner that day to the boys, and I suspicioned that most of the mothers sampled the food to see what the boys had been getting to eat. They had an abundance of things to eat. We furnished them an army ration of coffee, snap beans, bread, meat, potatoes, tomatoes, and one night we served ice cream. We had a general picnic on Saturday and had a basket dinner. We were fortunate that day in having with us Mr. Robinson, a great horse breeder from Kansas, and he gave us a splendid talk on horses and what he had done and what the boys could do if they follow out legitimate lines of breeding. And so we had a very interesting time with the boys.

More of us ought to take up this plan in our towns. You ought to induce your bankers and business men to finance it. The people at Sweet Springs held an encampment after we held ours and it was very successful. There are some things that you ought to look out for. In the first place, the sanitary conditions ought to be good. Our camp was located in a place that drains well, so that in case of rain the boys did not suffer from the wet ground. Then, we had our boys under military discipline and none of them could go away from the grounds without permission. While that was not absolutely necessary, it gave them a touch of militay life which they liked. All the boys were required to be at the lectures when they were in progress, and we had no trouble with them after they understood the proposition.

The expense of this encampment was considerable, and I am sure that the boys appreciated the efforts of the banks in their behalf, and the unanimous opinion of all the boys is that they want another encampment next year. It is my opinion that if we have another encampment next year we will have 1,500 boys, and it seems to me that the University here could arrange with the State

Board of Agriculture and the Agricultural College to send a detachment of its cadets out to the various parts of the State and let the boys at the encampments see a touch of military life and get in touch with the University. It is impossible for a boy to get enthusiastic over anything until he is brought into contact with it.

I will give you an illustration of how the trip to Columbia impressed one boy, who was up here last winter. At our encampment this fall, I asked him if he had some corn to bring to the fair and he said, "No, I haven't." (He did not have any that he thought good enough,) I told him he had better bring some along and we could find some place to put it underneath the rest, and so he consented to bring some. I found that his corn was not good show corn, and I showed him where to put it. After the show I asked him if he wanted the corn, and he said he did not. The last night of the fair when everyone was packing up corn and taking it away, I noticed a man standing outside. I knew that he had no exhibit there, and I asked him if he was looking for some corn. He pointed to the corn that this boy had brought and said: "I want to find the owner of that corn so I can buy it." I told him that I knew the owner and that it would be all right for him to take some of it home with him. A week afterward I met the boy on the street who had exhibited that corn, and I told him about the incident, I told him the man said that was the best corn he ever saw and he wanted to grow it. "Humph," he said, "He had better go to Columbia and learn something."

So you see the good the bank did in sending that boy up here; he was in Columbia just one week, but he learned that he did not know what good corn was. He told me that he was going to raise some corn for the next fair, and that the other boys would have to grow some good corn if they beat him. So you can see the good influence that the Agricultural College had on the boy.

I hope this idea of the Farm Boys' Encampment will grow. It is one method of reaching the farm boy, and in my opinion it is one of the best. It makes them enthused with the agricultural ideas, and they don't want to leave the farm and go to the cities, but they want to leave the cities and go back to the farm.

THE BREEDING PLAT.

(S. M. Jordan, Institute Assistant, Missouri State Board of Agriculture.)

I do not know the chapter in which the text may be found, but these are the words—"You may be able to get show corn by selection, but you must look to breeding to get the yielding corn."

If there is truth in the above statement, is it not plain that we are greatly in need of more breeding plats? No man can tell by an examination of two or more ears of corn as to which of them will be the greater yielder when planted in the field side by side and cared for in every way the same. Would you not rather be able to go to your field or crib and be able to select the heaviest yielders than all the other things that you do know about corn? A man who could do that would be an expert indeed, would he not? No man can pick out the yielders, and no man can tell when he has picked out his corn which of the ears will grow the more vigorously when planted under the same identical conditions. What would you give if you could go to your seed pile and pick out the ear that would yield the most and those that would grow with the most vigor? Can you think of any two things of more value than those two things would be? If you should imagine that you can do either one of these things, I will bet a coonskin against your old hat that if you will just try it and then plant these ears in a breeding plat, one ear in each row, and care for them the same, and give each the same chance, you will wake up to find that you will be sadly fooled, and you will have much less faith in your judgment.

Now, if these things are so important should we not find them out, if they are to be found out? Is there any way to tell the heavy yielders from the poor ones, and the vigorous growers from the weak ones? If this can be done, will it not pay us to go at it as that is the road to corn improvement?

We can find out just these things. The object of all this talk in the above lines is to start us to thinking right, and to let in light on the importance of "Corn Breeding." So the breeding plat will be the discussion in this article, and I shall endeavor to make it as plain as possible. There are some few methods as to the way certain things are done by different breeders, but the essentials are all the same.

The first thing that will be considered is the ground for the plat. I am inclined to the opinion that it should be rather good soil as it will take reasonably good soil to put good vitality into the corn to be raised. If the soil is the richest you have, it might not produce seed that would stand adverse conditions of poor soil. Also, the ground should not be too thin as that will not produce vigorous seed to plant in the richer soils. It will, no doubt, be best to select soil that may be the nearest an average to that in which your general crop is to be planted. The ground also should be as nearly alike all over as possible. If soil differing to any great extent were used it would not give all the ears an equal chance, and that is important as that will be the only means of a true comparison,

As to the amount of ground to be used, that will depend much on the amount of seed you need for your general crop and on the help you may have to do the work. From a half acre one can generally get enough seed to plant at least from 80 to 100 acres, and that is quite enough for our average farm. The same mistake that I made in the start is the one that is common in nearly every case, and that one is that we attempt too much. Do not try more than a half acre to start on, and you are more likely to get satisfactory results. Don't try more than one-half acre at first.

As to the selection of seed will say, that it is now too late to do that the very best way. To begin the selection before the corn is fully ripe is best, as an examination and a study of the plant can be made at that time, and the plant is the machine that makes the ear. By getting into the field before the corn is quite ripe and marking certain plants that meet the requirements it will be a great advantage. An ear should not be taken for the breeding plat that has not grown on a plant that has a good root system—and that can be determined to a great extent by the system of brace roots that appear. The corn plant cannot be any better than its root system makes it. It is further desirable that a stalk have strong short joints as that will give to it a better leaf system. The root system takes of the plant food as it is in solution in the water in the soil and it is thus carried to the leaves and there combines with the plant food in the air and in the leaf is where the plant food of the soil and of the air is manufactured into plant tissue. It is then very evident that the plant is well worthy of study to the corn breeder. A well-developed plant is necessary to vigorous ears. I prefer that the stalk also be of only medium height as that makes it less likely to go down in winds, and grows an ear lower down, which things are very desirable. The ear should be in height from the elbow to the shoulder, and when ripe it indicates that the shank is too large, which indicates a large cob, and also makes the ear hard to break off in husking and thus retards the rapidity of that process. Again, when it points upward the husks will often open up enough to let the rain into the ear and that will, no doubt, injure the vitality of the ear.

I would start with as good seed as could be secured as that will hasten the results that much. Any corn by selection and breeding can be made a good corn, but the better it is to start with the sooner will big results come. There are many corn growers in the State that have most excellent corn, and good seed can in most all cases be obtained from them.

Now, I would especially test every year and use no ear that had not shown in the test 100 per cent germination. Your work would be much of a guess after all if you used some ears that were weak in vigor or vitality, and much of the value of your work might thus be lost.

Then after the ground is well warmed up the planting will be the next thing in order. Many breeders prefer to drill, but I rather like to place it in hills. There are the good and bad features of both ways, but I think I prefer to hill as it will let me know that I get exactly the same number of grains in each hill and the same number of grains in each row. I think best to mark off the ground and drop the seed by hand, putting the same number of grains in every hill, then it may be covered with a hoe. So far, you see we have no guess work.

When the planting is ready to begin, I have my ears ready and plant one row from each ear, or as some prefer to plant at least two rows from each ear, as that will make us doubly sure as to the fact of no accident, for if results from the two rows somewhat remotely planted are similar, we feel that it is no guess work again.

Shell enough corn off the ear to plant the row, leaving the butt and tip and some rows entirely on the ear. Now take a small piece of card board and mark the number of the row on it and with a nail put into the butt of the ear fasten the cardboard to it, and that will keep the ear so that it may be found at any time for reference and comparison. Treat all the ears the same way and then lay them away in a box where mice and rats cannot get to it, and it will be a source of pleasure as well as surprise in many cases to see the ears that have made a good record or a bad one, as the case may be. We find in many instances that the ears that we thought our very best have proven to be perhaps our very poorest, and some that we thought only common will surprise us by being among our heaviest yielders.

Now, the next thing in order is to arrange a chart of the plat, that anything of importance may be noted on the chart. After the corn has been planted two or three days it will be well to see the plat every morning and it will be seen that certain rows will be coming up much ahead of others. All the slow rows should be marked on the chart, and mark them to be among the ones to be detasseled. No breeding is desired from the plants that lack vigor, neither should any seed be saved from such rows that are lacking in vigor.

It will also be noticed that certain rows grow and thrive much better than others—a fact to be noted on the chart. Also it will be noted that some rows seem to grow much taller than others, and if the height becomes too great, that row also should be marked for detasseling.

As to the rows to be detasseled it is evident that that fact cannot be determined until the work is about ready to be done. Many seem to prefer to detassel alternate rows, and for certain reasons that would be well, but in many cases a row intended to be left as a sire will be found to be sadly wanting in the things most desired in a sire.

Others allow the ears at planting time to determine the rows to be detasseled, but it is evident that that will not be best.

It might be well to state that the object of taking the tassels out of certain rows and stalks is to prevent undesirable breeding. The pollen or dust from the tassel is the male element of the corn plant, and the silk is female organ, and it is necessary that if the elements come in contact that the grains may form. When the tassel is removed from a corn plant it is the same as when the knife is used in our live stock. In our herbs we take out the bad individuals and thus prevent breeding from them, and the same laws hold in our corn work, and the results will be just as gratifying.

The time for detasseling will now need to be considered. It will need to be done as soon as the tassels begin to appear from the blades, so if the pollen has become dry enough to fall it is then too late, and the work will be of no consequence and perhaps work an injury in the bargain. At best the detasseling may do some harm to the yield as well as injure the growth of the plant, as it is a wound and the plant is very likely to suffer to at least a small degree on account of it, especially if the weather conditions are not favorable. It will be necessary to get into the plat every day for a few days at tasseling time, as they do not appear all at the same time, and it is not desired that they do all appear at the same time as that condition would prevent the corn from filling well, as all the silks do not come out at the same time, and also the weather has much to do in the complete pollination of the corn.

The most approved way to detassel is to pull it out. It comes off at the last joint very easily, but the reaching up so long is a very tiresome job. I have found a good and an easy method is to take a gentle horse, muzzle him, and by riding at the side of the row it puts one in easy reach of the work.

Now, as to what to detassel will have to be determined by the record as shown by what the various rows have done, any row lacking in vigor or showing anything not to be desired is to be detasseled, as no breeding is to be done by such. It is agreed that all undesirable plants should be detasseled, as that will eliminate the scrub individual. There are other rows also that we will want to detassel; at least half that show fine performance, as we want some seed that is not self-fertilized. There is a wide discussion as to what the effect of self-fertilization may be in the corn plant. It is naturally a self-breeder to a certain extent. Some of the pollen fertilizes the ear on the same stalk, and to limited degree will be inbred. The fact that it is naturally a self-breeder makes it best is very flimsy argument, to say the least. Only a casual glance at the things in which man has made improvement by diverting or changing the current of nature will settle that line of argument. It is the generally accepted idea that from the highest quality of the detasseled rows we will get our strongest breeders, those that will give us the most vigorous producers. The seed from all the rows of high quality should be carefully cared for, as the poorest are far better than the seed taken from the general field: All the bad breeders have been removed and that cannot be said of the rest of the field. Then for the ears for a breeding plat next season, let us have the seed from the highest detasseled rows. When the detasseling is done no further note need be taken save to watch for the effects, perhaps, of the detasseling, until the time comes to search for the ears for the next season, as is mentioned toward the former part of this article.

At that time we should note the time of ripening, the position of the ears, and anything else that we may see that might be of interest or profit.

Now in looking forward to the harvest several things should be considered. Count the stalks in the rows and determine how nearly a perfect stand has been matured. Note the number of ears as compared with the number of stalks in a row. The number of suckers may also be noted, and many other things that most any one will notice that may be of interest. One of the most important as well as one of the most interesting parts is yet to be played, and that is the harvest. Each row should be gathered separately and a careful weight taken, and a record made. Note the number of well formed and well developed ears as compared with those of inferior shape and quality. The highest yield of the best quality is the issue. It will be found that some of the "pet" ears, some that we may have taken to the show, and on which we won a prize, have fallen below the "dead line," while some of those that made no great pretensions have won out in the final and crucial test. Folks are sometimes that way, you know.

The corn that has given us the best results should be well dried out and put away for the general crop next season, and the finest and best ears should be carefully preserved for the breeding plat next season.

There is no question but that this method of work carried out for a few seasons will be a great help in vastly increasing our corn yields.

I have tried to make this lesson in corn breeding plain enough that any of the boys can understand, and it is hoped that many will go at it and put out a breeding plat this season. This has been a source of a big profit to me, and it will prove so to others.

First prize bushel of Boone County White exhibited at the State Corn Show, held under the auspices of the State Board of Agriculture in Columbia, January, 1909.

State Dairymen's Session.

Tuesday, January 5, 1909.

PRESIDENT'S ADDRESS.

(By P. P. Lewis, Crescent, Mo.)

Members of the Missouri State Dairy Association, Ladies and Gentlemen:

It is with a great deal of pleasure and not without some pride that I am permitted, at this time, to call your attention to a few of the many good things that this Association stands for and has accomplished during the nineteenth year of its existence.

In the beginning, those who fathered this Association appreciated the adaptability of this grand old commonwealth for dairy purposes. They felt that in the organization and coming together of the dairymen at least once in each year, great and lasting good would be accomplished in the exchange of ideas, experiences and observations, and in this manner they would be enabled to secure the best results from their chosen avocations in the shorter route of experience, in that they would profit from that of others.

Since this organization was launched, the best men in this splendid work have met together and have accomplished great good for themselves, their neighbors, and their State. By constant agitation and by advocating this phase of farm life they have brought it to the attention of the thinking men in every walk of life, having lifted themselves, with others, who have engaged in this business, from the common "mossback" or hayseed to what is now considered to be one of the most scientific—and when properly handled—profitable businesses in which a man on the farm can engage.

Year after year this Association has brought into our State men who are abundantly well qualified to speak upon the various sides of the dairy business, men who are recognized leaders in their several lines. Those who have been fortunate enough to attend these meetings have been caused, by coming into contact with and hearing these able men, to return to their homes and take up their work with higher ideals and a better appreciation of their business and with a desire, not only to make money out of the business, but to accomplish something that will be of more value to their homes, their communities and their State.

Through this Association and its influence our young men have been encouraged and made to look upon the farm and its work, not as an irksome and undesirable task, but as an avocation of which they can be proud. In fact, they have been lifted out of their former selves and made to feel, that after all, the farm means far more than drudgery, bent backs, aching hands and endless toil of an unremunerative nature, and that which has heretofore been looked upon as undesirable can be made, through proper application and enlightenment, which is afforded by the experience of others who have from time to time been before this Association and through our Dairy Department under the able and efficient Prof. C. H. Eckles, a splendid source of uplifting and upbuilding, not only from the financial standpoint, but from that higher standpoint which we all love to feel, that we have accomplished something which stands for good.

This Association has advocated laws that have been enacted for the control and the protection of a clean, pure and honest product, whether it be the manufactured product—butter, or the pure milk for the consumption of the thousands within our larger cities. It has advocated and has succeeded in having a dairy commissioner appointed, whose duties tend to the instruction and uplifting of the dairy interests.

Those interested in dairying in Missouri at this time number something like 35,000, about 5,000 having embarked in the dairy business the last year.

While in the past we have accomplished may good things, it seems to me that we are now just upon the eve of an awakening of greater interests and opportunities, and that this Association must zealously push forward advocating and protecting the interests of this great business.

I feel that the needs of this hour are educated dairymen, men who understand the feeding and caring for the cow and making and marketing the product, and this Association should advocate a change in our present laws covering the dairy and food work, and should ask our Legislature to separate the office of Dairy and Food Commissioner, giving two or more dairy instructors who are competent and able to teach the business from all its standpoints.

Year after year we have passed resolutions asking for an appropriation for the building of a dairy barn commensurate with this great interest, also other needed improvements, and we should now insistently demand an appropriation covering these important points and should give our every effort to the end that we may accomplish these results.

During this year we were unfortunate in losing our able and efficient Dairy Commissioner, as well as Secretary of this Association, Prof. R. M. Washburn, who accepted a position that suited him better. We should remember his work in our behalf and should at least tender him the thanks of this Association.

We have been fortunate in securing the service of Mr. F. L. Austin, who has taken the position vacated by Mr. Washburn, and who has so industriously given us his time and labor without any remuneration excepting the sincere desire to do good for our Association. I would suggest that, as this office is important and entails not a little work and some expense, as well as an ability to do the work, this Association should take some steps to secure for this important office some remuneration of a pecuniary kind, at least for the services rendered.

Our Association is also greatly indebted to Mr. George B. Ellis, Secretary of the Board of Agriculture, and to this Board for its interest in our behalf, not only for experience and ability to impart same, but also for financial aid.

I believe also that this Association should advocate a larger display of its interests—cows, butter, milk, cheese, and other products at the State Fair, held annually in Sedalia, to the end that the people of this great commonwealth may see the growing developments in the dairy business. Last year I noticed a very poor display of our business, so poor, in fact, that our agricultural papers have commented on the lack of interest evidenced by dairymen in this great work.

In closing, I wish also to add that we, as an association, should bring out the undesirable side of our business in a manner that will leave no wrong impressions, and should profit thereby. There seems to be a tendency on the part of our people, and especially is this true of the daily press in reporting our meetings, that the lot of a dairyman is one of roses without thorns. Every business of any moment has its reverse side and to accomplish anything one must fit himself for his chosen avocation. Education is a need in every line of work.

The successful dairyman is the one who takes an interest in his business, who tries in every manner to improve upon his present surroundings, and who studies it from every side. The impression that an old cow turned loose upon the commons, brought in at irregular intervals, and milked once or twice a week and curried with a milk stool, with a milk can and a small farm wagon for transportation, is all that is needed to embark in our business, it being only necessary to take life easy and draw dividends—is a wrong one.

Our work in any line is exactly what we make it. Our efforts in this business are to bring it to a higher plane and to take from our paths some of the many thorns that are now strewn therein, and in this manner make our chosen vocation brighter, better and grander from every point of view.

I thank you for the honor you have conferred upon me, and can only ask your indulgence in my expired term of office, stating that I have tried to fulfill the trust as best I know how. I shall now turn over the mantle that I have so poorly worn to my successor, promising him and the Association my continued support and interest.

FEEDING THE DAIRY COW FOR PROFIT.

(By A. J. Glover, Associate Editor Hoard's Dairyman.)

There is probably no question that is any more perplexing than the subject of feeding the dairy cow for profit. It is not enough to state the kind and amount of feed to give, but we must take into consideration the individuality of the animal, the amount of milk that she is giving, her care, her environment, her breeding and her owner. It is a dairy-bred cow, to be sure, that we shall have under consideration, but there is a great difference in dairy cows, not only in the production of milk, but in disposition and otherwise. It is a well-known fact that breeding for a special purpose tends to develop an animal that will be in harmony with her function. The dairy cow whose function is to make milk and who has for generations been bred for that purpose, does not retain and carry as large an amount of flesh and fat as the beef animal. This is due to the fact that her energies, and those of her ancestors, have been turned to the production of milk, and flesh has been made subservient to heat function. Because of these different functions, the dairy animal tends to become spare and angular while the beef cow tends to become square and blocky. Temperament governs form, and form governs functions. The dairy cow does not need very much meat or fat on her back in order to perform her function of making milk. If she carries much flesh it is an indication that she will consume a large amount of feed for the milk produced. In other words, the cow that carries more flesh and fat than is needed to indicate a thrifty condition is using more feed than she ought to for maintaining her body. The cow is not always to blame for this condition—the feeder is sometimes over-anxious to see his cattle look fat and sleek, and feeds them more grain than they are capable of manufacturing into milk. This practice is more or less injurious to the cattle, and it is a costly luxury. It is the observing feeder that watches these conditions and does not feed any animal more than she will consume economically.

A MAINTENANCE RATION.

Every living creature requires food to sustain life, whether it works or not. The loafing man eats, the resting horse consumes a certain amount of feed and it is none the less true of the cow. The steam boiler requires a certain amount of fuel to maintain the steam to a given pressure when it is not working. The cold air which surrounds it is constantly cooling the water, and in order to keep up steam some feed must be added. In animal life the surrounding atmosphere is constantly cooling the animal's body, and to maintain the body at a normal temperature, fuel must be constantly added. Moreover, it takes a certain amount of feed to supply energy to do the work the animal has to perform in extracting the nutriments from the feeds and to carry them to the different parts of the body. The fuel which the boiler requires to keep up a given pressure of steam corresponds very closely to the feed that the animal demands to sustain life, and bodily health, without gaining or losing in weight. The feed thus used is called the maintenance ration.

THE WORKING RATION.

When an animal is fed enough to support her body properly and the steam boiler enough fuel to raise and sustain a given pressure of steam, if either is required to do more to exert additional energy, each must receive more fuel. As soon as the engine is started it begins to take the stored-up power from the boiler and transmits it into active energy. The boiler will supply steam for some time to the engine without the addition of fresh fuel, but the time is short, and, if continued power is needed, more coal must be added to the fire. The harder the engine works, or the more steam that it uses, the more fuel will the boiler require. It is just so with the cow, for as soon as she begins to produce milk she requires more feed, and the more she produces the more feed she will demand. There is a limit, however, to the amount of work that can be done in either case. For instance, if the boiler is only 10 H. P. and there is a demand for 12 H. P., it will be necessary to crowd the fire with coal and increase the draft in order to produce the extra amount of energy. Every engineer knows that that is a wasteful way of producing energy. It is not only extravagant, but the boiler lasts only a short time when it is crowded to and beyond its capacity. It is generally understood that any piece of machinery should be stronger and capable of doing a little more than it is required to do under ordinary conditions. The cow should have the capacity of producing more milk than she is called upon to produce in ordinary herd work. It is not profitable, as a rule, to force a cow to the limit of her capacity. She should be fed all the feed that she will economically convert into milk, and at the same time retain her health and produce a strong calf. The working ration therefore does not mean crowding the machine continually to its normal capacity, and sometimes beyond, making it short-lived, and the cost of production unnecessarily high, but rather a ration that keeps the animal in good physical condition, produces a strong calf, and gives the most economical flow of milk.

A BALANCED RATION.

A balanced ration is the proper amount of feed to sustain the animal for 24 hours and supply her with ample nutrients to do her work economically. In calculating a formula for a balanced ration there are no hard and fast lines to follow. We have tables, to be sure, that are based upon the results of experiments; they are helpful in calculating our formulas for rations, but they cannot be followed to the letter or we will make serious mistakes.

A few years ago, I was on an institute tour through the Red River Valley of Minnesota, and I advocated the balanced ration, as it was taught to me in school. In other words, I formulated a ration, for a cow weighing 1,000 pounds, containing from 2.25 to

2.50 pounds of digestible protein, 12 to 13 pounds of digestible carbohydrates and .75 pounds of digestible fat. The next winter I visited many of the same places and I found from the questions that were asked, and through the discussions, that very few farmers had increased the flow of milk by feeding the ration that I had proposed to them the preceding year. What was the trouble? After investigation and considering the subject, I discovered that the cows to which this ration was fed were not dairy cows nor kept under dairy conditions. It was a waste of good feed for men to give much to a class of cows that were not bred for dairy purposes, nor cared for,by men who had no knowledge of handling dairy stock. If I had told them first to put their cows in a warm, well lighted and ventilated stable and give them all the hay they would consume and from four to five pounds of ground feed, I would have given them some information that would have started them on the way to become successful dairymen. But a ration containing from 10 to 12 pounds of concentrates, and roughage accordingly, was altogether too much for a cow housed in a poor barn and giving from five to ten pounds of milk per day. A balanced ration is correct enough, but it must be balanced to meet the condition for which it is fed and according to the amount of work that the animal is doing.

FEEDING ACCORDING TO YIELD OF MILK.

There is no better system of feeding the dairy cow than to give her a ration according to the work she is doing and to nourish properly her body. Let us be specific in order to illustrate clearly this point; supposing we have a 1,000-pound cow that is giving 25 pounds of 4 per cent milk daily, or is capable of doing this without crowding, and there is on the farm clover hay, silage and corn, which is worth $13.00 per ton, and barley worth $18.00. In the market we can purchase bran for $15.00 per ton; gluten feed for $25.00; oil meal for $30.00.

In calculating the amount of feed necessary, we first refer to our table to see what kinds and amounts of nutrient are required on the average for a dairy cow weighing 1,000 pounds, and producing one pound of fat per day. We find it requires 1.8 pounds of digestible protein, 12 pounds of carbohydrates and .5 pounds of fat. The next question: What combination of the named feeds will supply these nutrients the cheapest? We know from experience that corn silage and clover hay are good feeds for dairy cows, and they supply a large part of the nutrients at a reasonable cost.

An allowance of 40 pounds of silage is none too much for a cow weighing 1,000 pounds, and in 40 pounds of silage there is 10.6 pounds of dry matter containing .53 pounds digestible protein, 5.6 pounds of carbohydrates and .28 pounds of digestible fat. An animal of this size will consume in addition from five to ten pounds of clover hay, consequently, we will suggest that seven pounds of clover hay be added to our formula. In seven pounds of clover hay there is 5.9 pounds of dry matter containing .48 pounds of digestible protein, 2.50 pounds of digestible carbohydrates and .12 pounds of digestible fat. By adding the total amount of nutrients in the silage and clover hay together we find that we have 16.5 pounds of dry matter containing 1.01 pounds of digestible protein, 8.11 pounds of digestible carbohydrates and .40 pounds of digestible fat. So far, our ration does not contain enough nutrients to support the cow and make one pound of fat, or 25 pounds of 4 per cent milk per day. The question may come to you, why not increase the silage and the clover hay, until enough nutrients are supplied, for these feeds are cheaper than milk stuffs. A cow cannot eat enough of these feeds to produce the most economical flow of milk, unless the prices of milk feeds are exceptionally high and the price of butter fat comparatively low. Under such a condition it might pay better not to feed any concentrates but feed all the silage and clover hay the animal will consume without waste. She will probably keep up in flow of milk for a short time by drawing from her system the stored up energy that she created when dry, just as the boiler with a pressure of 150 pounds of steam will run the engine for a short time, without putting in coal enough to supply the engine with all the steam that it will use to advantage. The cow, like the engine, will adjust her work to the amount of latent energy or feed that she is given. Therefore, under ordinary conditions, some grain should be added to this ration. Experience and tables which have been tabulated from the results of experiments show that from seven to eight pounds of grain will have to be added in order to supply the cow with ample nutrients for doing her best work. What grains shall be added? In our silage and clover hay there is 16.5 pounds of dry matter containing 1.01 pounds of protein, 8.11 pounds of digestible carbohydrates and .40 pounds of digestible fat and we need for this cow about 1.80 pounds of protein, 11.94 pounds of carbohydrates and .47 pounds of fat, or there is needed the difference between the nutrients in the silage and clover and the amount required; which is .79 pounds protein, 3.84 pounds carbohydrates and .07 pounds of fat. Since we have learned from actual feeding experiments that corn has about the same feeding value as barley, and one can be substituted for the other, it is only business-like to note which is the cheaper. Corn costs five dollars less per ton, which makes considerable difference for feeds so nearly alike in feeding value. This indicates that it often pays to exchange some home grown grain for milk feed. How is it to be determined that barley or corn or any other feed stuff is needed at all? This is largely ascertained by chemical analysis and digestion experiments, the results of which are combined in feeding the tables found in books and periodicals, and is one of many illustrations of the benefits conferred upon the farmer by science and scientific investigations.

Whenever clover or alfalfa is fed it requires at least half of the concentrates to be rich in carbohydrates. Corn and barley contain a high percentage of carbohydrates and are comparatively low in protein. We take four pounds of the corn chop, for I said we needed from seven to eight pounds of concentrates. In the four pounds of corn chop there is 3.6 pounds of dry matter, containing .32 pounds of digestible protein, 2.67 pounds of digestible carbohydrates and .17 pounds of fat.

Corn chop is a heavy feed, and since a ration for a cow should be made bulky, a rather light feed ought to be added. I have assumed that bran is worth $16.00 per ton, gluten feed $25.00, and oil meal $30.00. In order to determine the total amount of nutrients that is already in the feeds which have been chosen, it is well to put them in table form and the formula so far is as follows:

	Feed Stuffs.	Dry Matter, lbs.	Protein, lbs.	Carbohydrates, lbs.	Fat, lbs.
Silage	40 lbs.	10.6	.53	5.60	.28
Clover hay	7 lbs.	5.9	.48	2.51	.12
Corn Chop	4 lbs.	3.6	.32	2.67	.17
Totals	....	20.1	1.33	10.78	.57

This supplies enough nutrients for a cow weighing 1,000 pounds, and giving 15 pounds of 4 per cent milk, but not enough for an animal producing 25 pounds of 4 per cent milk. The cow may for a time produce even more than 25 pounds of milk on this amount of feed, but she will draw on her system for extra nutrients and will, in time, decrease abnormally fast in milk flow.

To make this ration complete for the cow in question, we need about a half of a pound more protein, and a little more than a pound more of carbohydrates. In four pounds of the gluten feed we have .93 pounds of digestible protein, 2.03 pounds of digestible carbohydrates and .11 pounds of fat. This amount of gluten feed furnishes more nutrients than is needed, so let us try three pounds, and we get the following: .70 pounds protein, 1.52 pounds carbohydrates and .08 pounds of fat. This would do very well, but it gives a little too much protein and costs a little more than four pounds of bran, which has 3.5 pounds of dry matter, containing .50 pounds digestible protein, 1.54 pounds of digestible carbohydrates and .12 pounds of fat. This gives the proper amount of nutrients needed to balance the ration for a cow weighing 1,000 pounds and producing 25 pounds of 4 per cent milk. It gives the following formula:

Feed Stuffs.	Dry Matter, lbs.	Protein, lbs.	Carbohydrates, lbs.	Fat, lbs.
Silage, 40 lbs	10.6	.53	5.60	.28
Clover hay, 7 lbs	5.9	.48	2.51	.12
Corn Chop, 4 lbs	3.6	.32	2.67	.17
Bran, 4 lbs	3.5	.50	1.54	.12
Totals	23.6	1.83	12.32	.57

If the animal produces more than 25 pounds of milk add one pound of the grain mixture for each three pounds increase in milk. It is probably well to consider a ration made up of timothy hay and corn stover for roughage in order that we may note the kind of concentrates that will have to be selected to supply the proper amount of nutrients to a cow producing the same amount of milk. I will not go through the process of formulating this ration, but I will give the formula, which is as follows:

Feed Stuffs.	Dry Matter, lbs.	Protein, lbs.	Carbohydrates, lbs.	Fat. lbs.
Timothy hay, 10 lbs	8.7	.28	4.34	.14
Bran, 3 lbs	2.6	.38	1.06	.09
Gluten feed, 2 lbs	1.8	.47	1.14	.05
Corn chop, 2 lbs	1.8	.17	1.33	.09
Oil meal, 1 lb	.9	.29	.33	.07
Totals without stover	15.8	1.59	8.20	.44
Corn stover, 10 lbs	6.0	.17	3.24	.07
Totals	21.8	1.76	11.44	.51

Corn stover, as a rule, is fed ad libitum, but I have shown the amount of nutrients in 10 lbs. This makes a ration nearly as well balanced as the one containing clover hay and silage, but it is not as good a ration, notwithstanding it contains more expensive concentrates. It lacks a succulent feed, which is much appreciated by the milch cows. Moreover, timothy hay is not as good as clover when there is an abundance of corn raised. It is perhaps well to compose the composition of clover hay, timothy and alfalfa in tabular form in order to see why timothy is not a good hay where there is plenty of corn, and why alfalfa is such a very valuable hay for all kinds of live stock. In the following table we have shown the amount of digestible nutrients contained in 100 pounds of timothy hay, alfalfa and clover.

	Dry Matter.	Protein.	Carbohydrates.	Fat.
Timothy hay	86.8	2.8	43.4	1.4
Clover hay	84.7	6.8	35.8	1.7
Alfalfa hay	91.6	11.0	39.6	1.2

Clover hay contains about 2½ times as much protein as timothy, and alfalfa 4 times as much. In 100 pounds of corn there is 89.1 pounds of dry matter, containing 7.9 pounds of digestible protein, 66.7 pounds of digestible carbohydrates and 4.3 pounds of digestible fat. Since corn contains such a low per cent of protein and a high percentage of carbohydrates, it goes well with alfalfa, because it is richer in protein and contains much less carbohydrates. Let us make a ration of alfalfa and corn for a cow weighing 1,000 pounds and giving 25 pounds of 4% milk:

	Dry Matter, lbs.	Protein, lbs.	Carbohydrates, lbs.	Fat, lbs.
18 lbs. Alfalfa	16.5	1.98	7.03	.22
8 lbs. corn chop	7.1	.63	5.34	.34
Totals	23.6	2.61	12.37	.56

Corn and barley are about the only grains that will make a balanced ration with alfalfa. Corn and alfalfa not only make a balanced ration, but the combination seems to keep the cow in exceptionally good order. It is generally thought that it is better to feed at least two kinds of concentrates, not that the ration will be balanced better, but for the sake of variety. If corn is the only concentrate fed with the alfalfa it is well to mix some cut alfalfa with the corn, for the cow does not do well on so heavy a feed as corn if fed alone. She is built for a bulky ration.

We should note that there is enough protein in this ration to produce 35 to 45 pounds of milk, but only enough carbohydrates for 25 pounds. It is not so objectionable to have an excessive amount of protein as it is to have too much carbohydrates. To illustrate this let us make a ration of timothy hay and corn chop:

	Dry Matter, lbs.	Protein, lbs.	Carbohydrates, lbs.	Fat, lbs.
Timothy hay, 18 lbs.	15.6	.50	7.81	.25
Corn Chop, 8 lbs.	7.1	.63	5.34	.34
Totals	22.7	1.13	13.15	.59

In this ration there is enough protein to produce only 10 pounds of milk, or about one and one-half times less milk than the ration containing 18 pounds of alfalfa hay. A yield of two tons of timothy hay per acre is considered very good—at this rate an acre will produce enough timothy hay, when fed with corn, to produce 2,200 pounds of milk. It is not uncommon to grow four tons of alfalfa per acre, and four tons of alfalfa, when fed with corn, will produce 11,000 pounds of milk. In other words, an acre of land, when sowed to timothy, will produce 2,200 pounds of milk, and if sowed to alfalfa, it will produce 11,000 pounds of milk; that is, one half an acre of alfalfa and 888 pounds of corn will produce 5,500 pounds of milk, and one acre of timothy and 888 pounds of corn will produce 2,200 pounds of milk. Does not this illustration show that it is more profitable to raise alfalfa than timothy hay? There is another point which we have not considered, and it is this, that the timothy hay and corn make a very poor combination, not only for making milk, but for keeping the animal in good physical condition.

Feeding the dairy cow for profit involves the study of each animal in the herd; it requires that a man should know the amount of milk and fat that each animal is capable of producing; the dairyman should grow alfalfa and clover hay, instead of timothy, to feed with corn silage and home grown grain; a farmer should understand the relative composition of feeds, so that an intelligent combination can be made; the relative market prices should be ascertained in order to know whether it is advisable to exchange home grown grain for mill feed, and it is well to understand the relative prices of feeds and dairy products that we may know whether to feed concentrates liberally or sparingly. High-priced feed and low prices for milk or its products is an undesirable combination, but it is sometimes economy to submit to a present loss if probably profit in the future will more than counterbalance it. Bear in mind also that the food of maintenance must be supplied and only that which is fed in excess of this should be considered when the market runs the wrong way.

DISCUSSION.

Q. What breed of cows have you?

A. We have the Guernseys; but I don't think there is anything gained in a meeting of this kind by discussing the different breeds—I would rather say *dairy* cows. It is a matter of your own personal taste; you should select the breed you like best. And I don't think we should pay any attention to fancy points about the cow, either. Professor Spillman spoke to you last night about the cow with the stripe around her body being so much in demand. Now, that stripe doesn't mean anything. We have a cow in our herd which is almost a solid color, and some buyers would pass her by when looking through our herd; and yet she stands there year after year with a record of 400 pounds of fat—449 last year. Now, that's a pretty good cow, and she is one of the most economical producers we have. Last year she only ate $50 worth of feed, and returned a profit of $100; and yet if you were a Guernsey man you would not consider her at all. She is willing to take the grains that we raise on our farm and those that we buy, and give us over and above all the cost of her feed $100 in profit. Now, we should not let a little thing like that stripe influence us.

Q. In speaking of the profit from a cow, you do not include the cost of labor, do you?

A. No; just the amount of feed we put into that cow and take out so much milk.

Q. How can we tell when we are feeding too much?

A. You will notice that the animal is leaving part of her feed. And then you will notice it in the excretion—you will notice that the cow is not right constitutionally, that there is something wrong with her digestion.

Q. Does clover hay answer the purpose of alfalfa?

A. Yes; clover hay is also rich in protein. Alfalfa contains 11 per cent and clover practically 7 per cent. But don't misunderstand me to say that carbohydrates are not important. But here in Missouri, where you have plenty of corn, you are more concerned with getting protein feed, and when you buy feed you think of buying that which is rich in protein. But those of you who raise alfalfa are more independent; you don't need to go to market to buy. It very often pays to exchange home-grown grain for mill feeds. These glutinous feeds are improved in many ways by having the starch taken out. Very often the selling of home-grown grain and the buying of mill feeds can be done at a great profit.

Q. In figuring the profit on your cow, have you figured in the value of the skim milk?

A. Yes; at $15 per cow. The manure is not taken into consideration.

Q. Do you think that testing a cow once a month for 12 months and weighing the milk, is a fair test?

A. Yes; a very accurate test.

Q. I should think that there would be a difference in the result by weighing the milk every day and weighing it only once a month.

A. Your cow will not vary very much from month to month. She will not give this month 50 pounds and the next month drop down to 20, but will produce right along the first few months 30 to 35, then perhaps 29 and then 28—there is a *gradual* decrease. We had one cow that produced as much in the 12th month as in the first; she produced 49 pounds the first month and 40 the last month in the year. There is not very much chance in making a great mistake in that cow. If you go all over our records you will see a gradual decrease.

Q. Will you give us a balanced ration?

A. Six pounds of bran, 6 of corn and oats, 6 gluten feed, 3 of oil-meal, 12 of clover hay.

We feed corn silage and alfalfa hay, 30 to 40 pounds of the first and 10 of the last, and what corn stover she will eat out of that given her for bedding.

Q. How much grain do you feed a cow?

A. The most grain fed any cow last year was 10 pounds. Our average is 7 pounds of grain per cow. Don't crowd them. But you must remember that the feeding of good alfalfa hay in connection with silage gives a lot of nutriment; and you can get along with 1 pound of grain to 4 pounds of milk—that's enough here in the corn belt. In Wisconsin, when we get an inquiry as to that, we tell them to give 1 pound of grain for 2½ pounds of milk.

CLEAN MILK—WHY?—HOW?

By Dr. Geo. M. Whittaker, Dairy Division, United States Dept. of Agriculture, Washington, D. C.

Few people know what the word *clean* means. They think they do but they are mistaken. How many of you have a carpet on your living room floor which the good house-wife goes over daily with a sweeper, and which you take up and beat for her once a year—or two? Do you consider that a clean way of living? Contrast that method with a system of rugs which can be rolled up and taken out of doors weekly for a thorough sweeping.

Not many weeks since, I stopped at the leading restaurant in a bright enterprising city. The day was warm and the whole front of the place was open. At the end of the lunch counter not a dozen feet from the street gutter stood a row of uncovered pies. They were in the same air as that of the street; whenever a passing car or a natural breeze raised a cloud of dust, with all which that implies, the particles would settle on those pies. But more than that, a host of flies having taken a hearty meal on street manure and refuse were having pie for dessert. As far as I could judge I was the only one of those eating at the restaurant or passing on the street who considered the conditions as bad. If I had told the proprietor that he was running a dirty place, he would have resented the charge, possibly to my physical injury, for was not the white tile floor scrubbed every morning? How often do I hear dairymen boast of the number of times they strain milk as proof of their cleanliness, ignorant of the fact that the more milk is strained the dirtier it may become.

In defining the word *clean*, we must not belong to the class who having eyes see not. Our visual organs must be alert to visible dirt, even in out-of-the-way places; but we must also understand that there is such a thing as invisible dirt and lots of it; it is there just the same even if we can't see it.

The demand for cleaner milk has been a familiar sound in my ears for a long time. Many years ago, when connected with the Massachusetts Dairy Bureau, I frequently heard creamery buttermakers grumble at the dirty product sometimes furnished them and complain that they could not make Number One butter if even one farmer in twenty furnished dirty cream.

More recently the subject of cleaner milk has received increased prominence, and has come to the front all over the country.

This comparatively new movement has been inaugurated by physicians rather than dairy leaders; its official machinery has been put in operation at the instance of health boards rather than agricultural departments; and its object has been better market milk rather than higher flavored butter, although clean milk helps one as well as the other. This modern dairy agitation is not in universal favor with milk producers. The attitude of antagonism where it exists is to be deprecated because it is sure to end in defeat, for the agitation in favor of cleaner milk is based on proven facts, and truth always prevails. Further than that, these milk producers place themselves in a false light before the general public and create a bad impression by facing backward and opposing progress; though it is only natural that a milk movement originating largely outside of agricultural circles should be viewed with suspicion. It is a principle of law and logic that the presumption is always in favor of the existing order of things and the burden of proof is on those who would make a change; but many health officers know so emphatically the danger from contaminated milk that they do not make plain to others what they see so clearly themselves and they enact radical regulations without taking the producers into their confidence. In addition, the enforcement of these orders is sometimes entrusted to people lacking tact and employing unwise methods.

Milk producers as a rule are reasonable, intelligent people who desire to produce a proper article. But they don't understand why customs and conditions which have been approved for generations should suddenly be forbidden; the *why* of things should be explained to them. They can be led better than they can be driven. They should be approached in a friendly and helpful way rather than with the bearing of a policeman. But they must be in a receptive frame of mind. The successful farmer is receptive; is on the alert for new facts and is ready to receive and adopt them. Let us receive the new light about milk in the same spirit. Let us remember that physicians know more about health matters than we do, and receive their assertions as we do the statements of other investigators and specialists.

WHY CLEANER MILK.

What are the facts which warrant such increased attention to the Nation's market milk supply and so many new rules regarding its production and distribution? Speaking broadly this new phase of dairying rests on bacteriology which is a comparatively new science. It is a science which has thrown a flood of light into many hitherto dark places, and has revolutionized a number of lines of work—notably surgery. The old time surgeon would perform minor operations with his jackknife—if he were very clean, he would wipe it on his pocket-handkerchief. Such things would not be tolerated today. As the search light of the bacteriologist is turned on to dairying, we see why the word clean is so misunderstood, why conditions that existed unnoticed a few years ago are condemned today, and that dirty milk produces worse results than giving a bad flavor to butter.

What has this knowledge of bacteria shown us in regard to the milk supply of our towns and cities?

First, it is now an established fact that tuberculosis can be conveyed through milk from the bovine to the human race. This was the unanimous conviction of the delegates to the recent International Tuberculosis Congress in Washington, D. C., as shown by their vote.

Second, it is now absolutely proven that typhoid and scarlet fever and some other ailments are due to specific germs, and that many epidemics of these diseases have been caused by the scattering of the germs through a community, in the milk supply.

Third, and by far the most important of all, it is now known that the presence in milk of excessive numbers of bacteria even if they are not specific disease germs, may cause derangements in the digestive tract, specially of infants and invalids. It is proven that much of the mortality of babies is caused by undue quantities of bacteria in the milk they consume. "Often the action of this milk with infants is not that of milk but of poison" says Dr. Jordan, Boston's milk inspector. One-third of all the babies who are born, die before they are five years old, says one authority, and Dr. Darlington estimates that one-fourth of the entire death rate is due to the bowel and stomach diseases of infants. Vital statistics of Rochester, N. Y., showed an average for nine years of 222 deaths per year, during July and August, of children under five years of age. The introduction of a better milk supply cut the number down to 89. At the infant asylum on Randall's Island, N. Y., the death rate before attention was called to the milk supply was 40 per cent; with better milk the rate was reduced to 16 per cent. Hence the question you have asked me to discuss is important as a dairy problem, but it is also one of broad economic and social concern. McClure's Magazine for December says: "Barring the anti-tuberculosis movement, there is no line of hygenic endeavor that has enlisted as wide-spread and hopeful an interest in this country as the problem of obtaining pure milk." The milk of healthy cows is practically sterile on leaving the udder, and much of the subsequent contamination comes from the dust or dirt always floating in the air even in the cleanest places. Other bacteria get into the milk from unclean utensils and many from fles. Many of these bacteria are harmless in their proper place, but there are weeds in the world of bacteria as in the world of visible plant growth—a weed is merely a plant out of place. The forms of bacteria which are particularly active in causing intestinal and digestive disturbances are intimately associated with the so-called harmless ones. You cut your hand and bandage the wound because you say that if the air gets at it healing is delayed: really it is the bacteria in the air that do the damage. The cut may develop into an ugly sore because in common language dirt got into it; but really because bacteria got into it. These bacteria getting into the milk may make it unwholesome or dangerous. Bacteria are intimately associated with dirt. Bacteria and dirt may be regarded as Siamese twins in any milk discussion. The cleaner the cow, the milker, the stable and the milk room, the less bacteria-laden dirt or dust in the air, and hence in the milk. Before leaving the "why" of my topic I want to speak a word of explanation:

In connection with the danger from unclean or contaminated milk is a point not always explained to producers in clear, untechnical language. At meetings where clean milk is discussed it frequently happens that after the leading speaker has concluded, a gentleman in the audience will rise to take part in the discussion. His face is intelligent but lines of skepticism are evident—his bearing indicates that he is going to annihilate the lecturer. He tells the audience that he has used milk freely all his life and is alive and well to tell the story; that he has brought up a large family of children who have drunk milk in large quantities and all are ideals of health; that he has retailed milk for many years and never knew of a case of sickness due to his product; in short, if what the speaker has said were true the human race would have perished long ago, and he is "tired" of all this bacteria talk.

You have all heard this kind of talk—sometimes a sharp talker will use ridicule and sarcasm and bring down a hearty laugh on the lecturer.

What are the facts regarding bacteria and health: Health is man's normal condition and nature does much to keep him in health. She gives him power of resistance to help withstand the attacks of disease germs and other bacteria. But these resistant powers are very uncertain and unreliable. They differ with different people and with different periods of life. They are less in babies than in adults. They are not the same at all times in the same individual. As a rule they tend to decrease as we live an unnatural or artificial life. All the mysteries of life and death it is not given us to know, but we do know that one person may violate almost every physical law and live to a good old age—while another under apparently favorable conditions succumbs to typhoid fever or tuberculosis. Not every unvaccinated person exposed to smallpox contracts the disease. Many survive an epidemic of cholera. Not everybody who drinks unclean milk goes to an untimely grave. But it is wise to avoid as many chances as possible. It is not good judgment to cross railroad tracks in front of a moving train because you have never yet been run over. Because every cry of mad dog is not followed by a case of hydrophobia shall we lessen our efforts to eradicate rabies? If only one baby in 500 contracts tuberculosis through its milk supply, if that baby were yours or mine, would we not favor the compulsory use of tuberculin? Shall we allow sanitary science to keep company with the lost arts because many people are tough enough (have sufficient resistant power) to live in spite of bad conditions? Shall we feed the babies of our cities with poisonous milk because it does not act with the quickness and certainty of arsenic?

CLEAN MILK, HOW?

The remedies for the three forms of bacterial contamination of milk are prevention: First, all cows producing milk to be used raw as a human food should be tuberculin tested. This test will not only result in a safer supply of milk, but it will help the producer by saving him from loss. Tuberculosis is a menace to the cow raiser and owner, subjecting him to great losses, and it should be exterminated to prevent these losses even if there were no question of public health. Tuberculosis is a formidable enemy to animal husbandry. The annual tuberculin test is based on the same principle of economy as the purchase of an insurance policy.

Second: No person should have anything to do with milk who has any contagious disease or when any such disease exists among his immediate associates. Take typhoid fever as an illustration; the seeds of this disease come only from the feces of some person who has or has had the disease, and these germs get into another person only through the mouth, with food or drink. These germs are frequently spread by getting upon the hands of some one who has had the care of a sick person or the bedding or clothing of such person and who, without washing them so that they are bacterially clean, touches food or handles utensils in which food is prepared or stored. The disease may be spread by flies crawling over infected excreta, getting the seeds of the fever on their legs and bodies and then visiting the milk pail or can. Recent medical papers are reporting an epidemic of 53 cases of typhoid fever in Denver, Colo.: Every family in which it appeared had milk from the same dairy. The wife of the dairyman was found to be sick with the fever; the excreta were not properly guarded, and it is believed the infection was conveyed by flies.

To avoid infection of milk from contagious diseases take precautions as to the health of those who handle the milk and milk utensils as well as the associates of those employed in the dairy. Sterilize bottles and utensils everytime they are used, keep flies away from the milk and every thing with which milk will come in contact. One hundred thousand fecal bacteria have been found on the legs of a single fly.

Third: Practice the greatest possible cleanliness in every detail relating to the dairy. This brings up emphatically the *How?* of my subject.

If clean milk is desirable because dirty milk is unwholesome, then we want to come as near as possible to clean cows, clean milkers, clean barns, clean milk rooms and clean utensils, remembering that cleanliness has a new significance now-a-days. But there is so little realization of the meaning of the word clean that were I stop here I fear you would take from this talk very little in the way of helpful suggestion.

The modern sanitary milk movement is so new that as I have said, many do not know what the word clean means, and that many time-honored practices are bad. Within a few months I visited a dairy and found the proprietor an intelligent, successful farmer, who began to apologize effusively for his old barn, saying that he intended to build a new one as soon as he could get at it. It was not very good, but I found the interior of the barn dark, damp and dirty. A pile of mouldy hay in one corner sent out a stench to mingle with odors of horse manure and cow manure in an indescribable blend. Men were milking with filthy hands and pouring the milk through the foul stable air into cans about which myriads of flies buzzed in anticipation of a balanced ration of manure and milk, sometimes coming to an untimely end in the latter. That man was ignorant of the fact that his methods were bad in the extreme and he *apologized for his barn.*

(a) Remember that most of the contamination of milk comes from the dirt or dust in the air; that all air contains some impurities constantly settling on or in every exposed substance, like flakes of snow in a snow storm; that the dirtier the room and surroundings, the more dirt there will be in the air and in the milk. Hence, milk should be exposed to the air as little as possible, and what exposure is imperative should be in air as clean as possible.

In order to meet these requirements provide yourself first of all with a small-top milk pail. An opening one-half the usual size will keep out one-half the usual amount of dirt.

Then the cow should be clean; that is, she should be daily brushed or groomed, the long, dirt-retaining hair on the udder should be clipped and the udder itself carefully washed before milking. Don't assume that it is clean because you can *see* no lumps of dirt on it.

The milker should wash his hands before sitting down to milk and should wear clean overalls or apron.

To further eliminate dirt and bacteria from the air, the stable should be constructed with smooth and tight floor, walls and ceiling; and the mangers and supports should be plainly built and simple, giving the smallest possible opportunity for dirt to lodge with the chance that some will be wafted into the milk pail by stray currents of air. All of the stable should be kept free from dirt and cobwebs, and whitewash should be frequently used.

When a cow has been milked, the milk should be removed at once; every instant it remains exposed in barn air it gathers contamination. It should be taken to a clean milk room. A place with cement floor, tile or cement walls, smooth ceiling, no rubbish and storage, and with fly screens, can have purer air than the stable. But even here there should be no delays by which the milk is unduly exposed to the air. The milk should be promptly strained and run over a cooler. A word as to straining; dirty milk cannot be purified by straining. An occasional hair or straw or bit of saw-dust may accidentally get into the milk in spite of the greatest care, so some straining is necessary. But much of the filth that gets into milk is soluble and microscopic and goes through the strainer. The gospel of clean milk is not a cheese cloth gospel, but a gospel of prevention.

The importance of prompt and efficient cooling of milk cannot be exaggerated. As bacteria multiply rapidly when warm, but cease activity when cold, the ideal way of handling milk is to cool it to 50 degrees F. promptly after milking. Then bottle or can at once, and cover promptly. Avoid unnecessary contact with the air. Don't leave the cans uncovered under the mistaken impression that this is necessary in order to allow the animal odors to escape. Clean milk has no animal odors. Finally store the milk where it will keep cool till delivered.

In the delivery of milk avoid contact with the air and with flies. The cleanest and best way of delivering milk is in glass bottles. Dipping from the can is very objectionable. Drawing from a faucet-carrier has less exposure to street dust than dipping from a can, but is far from ideal and has the further disadvantage of the impossibility of thoroughly mixing the milk; hence some customers get less than their honest due in milk solids, and some may get milk which is illegal from the chemical standpoint, subjecting the dealer to the liability of a court summons.

(b) A second source of contamination of milk is the utensils. If not perfectly clean the dirt is full of bacteria which will contaminate the milk. When made of tin, utensils should have no crevices or seams, hard to get at in washing and concealing millions of bacteria in the dirt and decaying curd. A superficially clean pail or can may be disgusting when you examine the seams. A liberal use of solder should render the inside of all pails, cans, dippers and strainers perfectly smooth and cleanable. Battered and rusty tinware is to be avoided. Utensils should be rinsed in cold or lukewarm water, washed in warm water and soap or soda, rinsed again, sterilized in ample steam or boiling water and inverted in pure air to drain, to air, and to keep out dust and flies. The bottles should have the same treatment. The water should be bacteriologically pure; many epidemics have started from impure washing water.

To get a proper city milk supply a campaign of education must come first. Consumers must know what to demand. Producers must know how to supply the demand. Prof. Dean of Canada says: "Ideals attained by means of education are possibly more valuable than those attained by force, but the latter make much better time. The 'please be clean' campaign has been largely a failure, and it would seem as if something sterner is necessary in order to obtain clean milk for use in the home."

My experience and judgment differ from his. Too much anxiety "to make better time" may cause disaster. A campaign of education first; next, invoke law to prosecute and exclude from the market the minority of producers who are wilful or negligent and cannot or will not clean up. There must also be sound public sentiment endorsing such action by the health officer.

A Rhode Island farmer, president of a local agricultural society, in his annual address, said:

"It behooves the milk producer to read the signs of the times and so to improve his product that he will not fear coming legislation, which, on the ground of public health, may be expected to exclude much of the milk now sent to market."

It is one of the functions of an association like this to push the educational phase of the work; to explain these "signs of the times" to milk producers so that the progressive ones may voluntarily clean up and practice satisfactory methods. This association can in this way be of great assistance to Missouri milk producers who should loyally sustain it.

Considerable experience, not a little of which has been in your own State, has convinced me that an ideal combination of educational and police work with a minimum of friction can be secured by the score card system of inspection. A certain number of points are assigned to each of about 60 different subjects and the inspector expresses his judgment on each one in turn by a figure. He secures the most helpful and friendly results by talking with the farmer as he scores. To illustrate: Six points are allowed for cleanliness of the barn; the inspector can call attention to dirty windows, to cobwebs on the ceiling, to manure spattered on the walls, to dirty floors; the farmer sees all these, no controversy can arise over their existence; perhaps the inspector says to the farmer, "Now, sir, calling 6 perfect how many points do you think it would be fair to allow you for cleanliness of stable?" Eight times out of ten, the farmer himself will place a correct estimate on his own conditions. The inspector proceeds similiarily with other topics on the card. When the whole card is filled out the figures are added in the presence of the farmer. There is no mystery about it, and nothing arbitrary. The final rating is incontestable, and at the same time so manifestly fair that no criticism can be made. But should he feel that injustice has been done him it can be easily proved or disproved by a comparison of his promises with the permanent record on the score card. I have made hundreds of inspections in a score of states. In only two instances have I met with any but the kindest treatment. Very often my work is received with thanks, and a pleasant invitation to call again. Another advantage of the score card is the greater simplicity of regulations resulting from its use. Instead of burdening the farmer with remembering a lot of rules, instead of irritating him with a multiplicity of "Thou shalt nots," we can have this simple rule: any dairy scoring below a certain point, say, for instance, 50, will be regarded as unsanitary, and its product will be rejected by the city health officer. The score card, instead of drawing an unexplained, mysterious dead line, constantly holds out a temptation to progress. A Tennessee inspector told me recently of a producer, saying to him: "My score is 60, but it will be 65 the next time you visit me, for I see where, without much trouble, I can gain 5 points."

From the official side, the score card is valuable, because it furnishes a good record of the work of the inspector. It requires a written statement of his judgment in such a way as tends to thoroughness, fairness and impartiality; and the file of these cards has no superior as an office history of the work of the inspection department.

HIGHER IDEALS IN DAIRYING.

(By Dr. D. F. Luckey, State Veterinarian.)

People are beginning to recognize the fact that agriculture is a big, broad, deep science. Its pursuit requires skill, common sense and energy, but in dairying there is a greater latitude for the use of brains than in any other department. Of all the special branches of agriculture, dairying is the most complex. A successful dairyman must be a judge of real estate in order to strike a bargain in purchasing his farm. He must be a judge of the dairy cow in order to intelligently select his stock. He should have some knowledge of horses, hogs and sheep, all of which are often profitable accessories to the dairy farm. He must understand hygiene, in order to keep his cows in a high state of health. He must understand pedigrees and the principles of breeding, in order to propagate a profitable herd. He must understand the chemistry of the soil, in order to properly rotate his crops and keep up the soil fertility. He must understand seed selection and crop cultivation. He must understand animal nature, in order to coax his cows into their best efforts, and human nature, in order to get his hired help to perform regularly, faithfully and efficiently the work about the dairy farm. He must almost be a bacteriologist in order to practice cleanliness necessary to make his product a blessing, instead of a curse. He must understand business methods, in order to find a profitable market for his products. In short, the most successful dairyman will possess the qualities of the real estate man, the live stock judge, the hygienist, the breeder, the chemist, the agronomist, the physiognomist, the bacteriologist, and the merchant. Love and gentleness must rule his nature, for an ill-temper is a misfit in a dairy. He is making merchandise of motherhood. He is putting on the market an article of food fraught with wonderful possibilities for the production of life, strength and health or weakness, disease and death. Is it too much to ask dairymen to have a high ideal?

Good, pure milk is a precious food. It gives life and strength to the babe and to the invalid. To the laborer who goes forth in the full strength of years, it gives more energy than other food that he can purchase at the same cost. To the professional man it is ever a restorer of his wasted nerves. To the housewife it is the ultimate consummation of convenience and usefulness. It is the one perfect food of the Divine Chemist. In the great plans of nature there is no substitute for it. The man who produces it should have a clear mind, clean hands, and a pure heart.

Bad, impure milk may be dangerous food. If any of its natural properties are removed from it, or water added to it, it loses, at least, a part of its food value. It may only fill space at a time when nourishment is most needed. If it contains either filth or preservatives, it may actually become poisonous. If it is from diseased cows or is contaminated with disease germs on its way to market, it may produce disease and even death. It should not be produced and handled for the human family like a scavenger gathers offal for hogs.

There is room for higher ideals in all occupations. Perfection can never be reached in any of them. It will probably be more difficult to approach perfection in dairying than in any other occupation. Nevertheless, dairymen should have high ideals in view, and strive and strive, and keep on striving for greater perfection.

Dairymen should never go on record as opposing reasonable reforms in the dairy business. No one can deny that heretofore there has been a general lack of cleanliness and sanitation about dairies. Long practice of watering, skimming and adding preservatives to milk has apparently led some dairymen to believe that they have an inherent right to practice such fraud. * * * There can be no doubt about it being wrong to sell milk from tuberculous cows; or to sell skimmed milk for whole milk; or to use preservatives in milk; or to sell filthy milk. When a few dairymen stand out in the open in favor of these fraudulent practices they cast serious reflections upon the whole dairy industry. The public is led to believe that dairymen are a lot of crooks. The respectable dairymen should be the most severe in reproof of those who are bringing disgrace upon this, the most honorable of all industries.

Dairymen should not only discountenance practices that are palpably wrong, they should take active steps to right all wrong. It will pay. If the dairymen do not correct their own faults the public will do it for them. The public is already aroused on the milk question and are demanding corrections. Opposition by a few crooked dairymen to reasonable reforms not only brings the dairy industry into bad repute, but turns people from the use of dairy products.

Good milk is the cheapest article of food now in use. Filthy milk from diseased cows is dear at any price. The demand for the highest priced milk in the cities, on account of its high class, is greater than the demand for the cheaper grades. Dairymen should strive to produce nothing but milk of high quality, free from dirt, preservatives and disease, and then ask a profitable price for it. The public has already shown a willingness to pay a profitable price for good dairy products. Instead of trying to produce milk at a low cost, even at a sacrifice of its purity and quality, dairymen should go to any necessary trouble and expense to produce wholesome milk, and then ask a profitable price for it. A pint of milk is said to equal in food value four eggs, one-half dozen oysters or a pound of steak. It is available as a food for infants and invalids. It is easily digestible. It is little trouble to prepare for the table. It can be used in a great many different ways in cooking. Altogether it stands alone for convenience and usefulness. Compared to other articles of food and drink, milk is selling too cheap today. If dairymen will stand together and discountenance the dirty, filthy practice of some of their own numbers, make an effort to secure absolute purity in all their own products and educate the public up to the real value of good milk, they will not only command better prices, but are sure to create an increased demand for their products.

Another point might be raised here. It is not so much one of higher ideals as of business foresight. Dairymen are allowing a public slander of skimmed milk. By a few dairymen trying to sell it for whole milk it is being brought into unjustifiable disrepute. An inspector recently stopped a shipment of skimmed milk which was sent to market as whole milk and the papers spoke of it as though it was poisonous. The truth of the matter is that the principal food value of milk is in the skimmed milk. I believe it will be found wholesome for more people for drinking than whole milk. Skimmed milk has a great food value, is palatable and digestible. It produces fine pigs and calves, and has made a fine physique out of many a baby boy. Dairymen should present these facts to the public and put skimmed milk on sale, but should not fall into the fatal and detestable practice of trying to sell it for whole milk.

Suppose two cases: First, a city in this State undertakes by ordinance to require that milk shall be from healthy cows; that it shall be kept at a temperature unsuitable for germ propagation; that it be kept clean; and, if it be called whole milk, it shall be whole milk. Then a few dairymen about the city object to complying with these reasonable requirements. They hire lawyers and go into court. The facts go from the courts to the newspapers. Consumers read the papers, and many of them quit using milk. Many of them use it with only fear and trembling for the safety of their children. What impression does the public get of the dairymen? What is the effect upon the demand for milk? Who is to blame?

Second, the dairymen around the cities in this State go to work of their own accord, and have their cows rid of all disease. They agree to keep their milk clean and to have it just what it is represented. They evade nothing that is fair and right. They take pride in their herds, and invite their customers to inspect their cows and the way the milk is handled. They openly advance the price to cover the extra expense of keeping things in a proper condition. They make a milk inspection ordinance unnecessary. What impression does the public get of these dairymen? What is the effect, in this case, upon public opinion and the demand for milk?

In conclusion, I would like to urge that the progressive dairymen of this State, assembled here to day, take the initiative in correcting existing evils in the dairy industry. Now is a good time for this association to go on record as favoring all that is right and fair in dairying. It is not sufficient for a majority of dairymen to live up to right principles. The majority should urge the minority to do the same thing. If, in due time, a few dirty crooked dairymen fail to catch the proper spirit, State laws and city ordinances emanating from the dairymen themselves, should be passed requiring rectitude of them. There can be no gainsaying that voluntary action upon the part of the dairymen to bring about perfection will lead to a better demand and better prices for dairy products. What is better, it will win for dairymen the universal esteem of all mankind.

BETTER DAIRY FARMING.

(By C. T. Graves, Maitland, Missouri.)

Mr. Chairman, Ladies and Gentlemen:

In consenting to take part in these exercises it is more than likely that I failed to appreciate the magnitude of the meeting. I regarded it as a sort of "experience meeting," where a small number of farmers would assemble and recite the ups and downs that we experience on the farm; but upon receipt of the programme I find that we farmers are to mingle with the leading talent of our State and of greater places. In the quiet of the little farm home, or on a blue grass carpet, among the cows for inspiration, I can tell to a visitor the things that have cost me time and money in handling live stock the past twenty years, but before an audience of this character it is different, and I feared to trust myself to make a talk.

My remarks are intended to apply to the small dairyman or farmer, who does not milk to exceed fifty cows and preferably not more than twenty. I will make no attempt to advise the two hundred cow dairyman. I can see how cows can be made profitable and the business be made gratifying so long as the owner does not have to become a slave to the business. Let us not censure the son or the hired man for his inability to see fascination in groping about in a cramped, dark, filthy, cheerless building filled with cows plastered with their own voidings. Marvel not at the lack of appreciation of milk products so long as you see the fields being robbed of fertilizer that is so frequently found in the bottom of a glass when the would be consumer of milk is about to empty his glass at his city home or boarding house. Have charity for the packer and grocer who has undertaken to sell as human food much of the butter that finds its way from the country store to the city grocer. I have been a country merchant, and can still see and smell the vile stuff that made up the larger portion of our shipments. Contemplate, if you will, what pleasure or profit there is in milking cows and caring for the product on the average Missouri farm as it is usually handled. Why are the boys leaving the farm, and why does another man's son hesitate to take the place of the one just gone? Who is entitled to the credit for that stable aroma in that milk? Who is to blame for the conditions that exist? Should we wait for officers of the law to enforce reform? Let us take up the cross and bear it cheerfully. Let us build up respect for the business in which we are engaged. Do not wait for a neighbor or a community to begin. It is a thing that *we* can do alone. If it is your wish to sell cream, prepare for it, and strive to excel in that line.

I am at a loss where to begin this reform. Some say get better cows. In defense of the cows permit me to say that comparatively few cows in our State have ever been invited to participate in a reform. They have had sentence pronounced upon them without a trial. Some say practice better feeding. To this we can all agree if it be made to read *more intelligent feeding*, but other factors are of equal importance. Some say there is no profit, unless we can get a better price for our product—a view that I once held. About that time when I was dreaming of getting a customer for fancy butter at about sixty cents a pound, Ex-Gov. Hoard of Wisconsin, to whom I owe so much, said in the Dairyman, in reply to a question along that line, "study not to increase the price of your butter, but to reduce the cost of production." This impresses me as the essence of the whole matter. It remained for me to determine the many factors that influence the cost of production, and I continue to find them. The problem will afford any man ample opportunity to exhaust all his mental forces, and I do not wish it understood that I have proven more than a few of them. My advice is to begin the new order of things with the stable or a place to properly care for cows with comfort to the attendant. If you are milking five cows on the run in a barn lot sell two of them and use the material which the money will buy, as I direct, and you will be well repaid. If you are milking ten cows in an apology for a stable, six of them can be made to yield more net profit. Assuring you that I have no patent on stables or appliances, will pass the stable matter, except as it may be mentioned in a general way as a highly important factor in the economical production of milk, cream, butter or animals. The same sort of a place that will enable a cow to work good, remain healthy and give birth to a vigorous, healthy calf, will afford the attendant a cheerful place to work. If you expect the best results from a cow, you must not stop at making her *comfortable.* She must be surrounded with conditions that will insure to her her full powers, and if she is not afforded all the pure fresh air that she needs to breathe and the invigorating influence of every day's sunshine she will suffer to that extent, and the owner will pay the penalty. I have entered many an expensive cow stable on a winter day, and found it more cheerless and uncomfortable than the outside. About a year ago I was the guest, for a day, of a man in a high position—a man of honor and of education. He had recently erected a new dairy barn, and invited my criticism. The main posts in that barn cost ten dollars each in the nearby city. It was an expensive structure, and housed a lot of stuff. The cows stood in long rows, the very narrow passageway in front serving as a manger, feed box and walk; the walk behind the cows so narrow as to make a man squeeze through. The cows were stabled about three o'clock that afternoon, but even at that time, they were examined with difficulty. The hay shut off all the light in front, and the few holes in the low wall in rear of the cows were the only sources of light. If practical experience had only guided the designing of this cow house, less than half the money would have provided a convenient and harmonious arrangement, enabling its grand owner to get results not worthy the attempt in present form. They were milking sixty-five cows. Only seven miles away another man was milking twenty cows in a cheap structure. Both had access to the same market, and the twenty cows were returning within a few dollars as much as the sixty-five. As to net profits you can draw your own conclusions. When I told this friend that I could sort out twenty-five of his cows, discharge two men, reduce his feed bill and supply the same amount of milk, he took it as a joke. Let us emphasize the value of sunlight and an abundance of fresh air—and I do not mean the sunny side of a wire fence, but a warm stable that admits the sun and *well provided* with ventilation. Not ventilated by open doors or windows, but as Prof King has most perfectly worked out. It is not a hobby of some "book farmer," but a reality. It is of equal value to your best feed under the proper conditions. It is of value not only to the cows and to the fall calves that wise dairymen have, but will bring better results from your men doing the work. You can clean your stable, brush your cows, prepare their feed and draw their milk in comfort. Provide your cows with a warm and thoroughly ventilated stable, if you have to sell half the herd to do it.

After you have provided facilities to keep the cows in full vigor, and to economically feed and care for them, having provided against waste of feed and bedding, take up the feed question. Alfalfa and corn silage should come first on the list, but this is a fitting time to urge the necessity of a good variety. Cows should eat with a relish, and it is important that their meals be made palatable. Alfalfa and silage will not satisfy them. They like a change of diet the same as a person. When you decide on silage do not strive to grow the greatest amount of fodder, but select a variety that will give you a generous amount of foliage with the largest per cent of grain possible. Silage is very bulky, and there is a limit to the amount a cow can consume. You may fill her up, and yet she may lack the essentials necessary to produce a liberal flow of milk.

Alfalfa hay is unexcelled, but very bulky, and the cow can not reach her limit on it for this reason. With silage and alfalfa hay some concentrated feeds like oil meal, cottonseed meal, ajax flakes, gluten feed, ground barley or oats must be fed to do her best. If you have twenty acres of clover and can not put it up right, cut the piece in two. Cut it early when it will make prime feed and cure it under caps. With most men clover hay is good enough when cattle will eat it, but that is not enough if you are after results. It is a rare sight to see a load of *good* clover hay, that is, good milk producing feed. It pays to prepare a good seed bed for clover as it does for corn and to put plenty of seed in the ground, insuring a larger crop of finer quality. We are inclined to attempt more than we can do exactly right, and with cows it does not pay. The details decide the matter of profit. Be particular to grow *choice* feeds, and buy the byproducts of mills to properly balance the rations. Along with the feeding problem do not underestimate the necessity of inducing a cow to drink large quantities of water. It pays to warm the drinking water for your cows, but the next best thing is to place a trough at the well and drop everything else at regular times twice daily to coax the cows to the well and pump as they drink. Ice cold water is responsible for much indigestion in well fed cows. Last winter, for a time, I took the feeding at the barn and wanted to increase our milk flow without buying any cows. The cows were thought to be doing fairly well. During the coldest weather we got more milk than in June on the best of blue grass and some grain. I have a steam pipe leading from the boiler in the dairy room to my water trough. After the cows finish their breakfast they are turned into the yard and the live steam turned on. The water would be positively warm, and with all the cracking noise of the steam the cows would drink right up against the discharge of the steam pipe, their heads being enveloped in the vapor. I prefer this plan of watering to any stable plan. At this time the cows were being fed corn silage, corn meal, gluten feed, oil meal, cottonseed meal and alfalfa hay run through the cutter. The cut alfalfa would be placed in the mixing bin and thoroughly wet with boiling water, and allowed to stand a few moments, the other feeds then added and well mixed. In less than two weeks the milk flow increased nearly twenty per cent for the herd, the cows that freshened late showing the best gain. This plan was not new to me, and I mention it only by way of illustration.

You may think it about time to connect some cows with this dairy problem, but I have found that cows are only incidental to *profitable* dairying, unless accompanied by controlling factors. One of the small ones that has proven of value to me in working cows is the keeping open of the pores of the skin by gentle grooming. It assists in promoting the health of the cows, but accomplishes another purpose. It establishes a very friendly relation between the cow and her attendant, a very valuable asset. If you are trying for a record which every dairy cow owner should be doing, this little feature should not be ignored. You can add still a little and ofttimes much to the work of a cow by the manner in which she is milked. It is not necessary that a cow be milked with lightning speed, but rather steadily and gently. Avoid too much teat pulling, but instead get the hand well up against the base of the teat going further up on the udder as the udder is being relieved. It encourages exhaustive milking and gets the last of it containing the most fat. After all that can be said, our hope is mostly in the beginner, and not in the "old timer" "sot in his ways." Why do we continue in this slip-shod way fooling with cows, deluding ourselves into the belief that we are dairying. Let us awaken to the fact that within our own ranks we have the most uncompromising foes to profitable dairying—our own indifference and cows lacking in dairy tendencies. Why continue to milk and market the product at a positive loss, unprofitable cows that should go to the packer and cease to figure in competition? A well organized plan of cow farming will afford interesting and remunerative employment for the sons growing up and will enable one to double the earning power of his land. I can go into the average herd and select cows that will respond to proper treatment and the improvement will not all come the first year. Examine the work of the cow at Auten farm—Jacoby Irene—and you will note that her capacity has been steadily developed. For three years in succession she has been on test and furnishes abundant proof that with proper care a cow can do heavy work and be benefited. The best fed cows are the ones returning the greatest net profit and when I say the best fed, I wish it understood as the most intelligently and most liberally fed, generously fed, a variety of milk producing feeds that rank high in quality, nearly all of which can be grown on the farm. Let me emphasize *quality*, so important in every phase of dairy farming. Do not strive to grow the largest acreage, but the maximum yield per acre of the feeds that will produce the desired results. Bear in mind at all times that this machine we designate the dairy cow is profitable or unprofitable as the owner or attendant wills. You may put a little fuel in the boiler and warm the water, but if we desire *power* we must have steam, which means more fuel. Give the cow the food of support only and she will continue to exist and the additional food beyond the amount necessary for support will decide the matter of profit. Select corn for your silo that has the greatest feeding value, and I advise a kind that has the smallest stalk and smallest cob possible. No doubt there are parties here who will take issue with me on this point. Neighbors fail to see this as I do, and I have at least one friend expected to attend this meeting who is positive that he can see greater profit in growing the largest possible amount of green forage to the acre. We are at the seat of information—our Experiment Station, and I hope that it will be possible for me to make my contention clear to the force at Columbia and to the representatives of the Agricultural Press. If we are to practice "better dairy farming" as I see it, we are to grow the best of corn, clover and alfalfa, all very bulky feeds. I advise growing some roots, pumpkins and the like for relishes, but the main dependence to be the three feeds mentioned, the clover and alfalfa to take the place of high priced bran. The impression that we can not eliminate bran from our bill of fare seems to prevail. We should look largely to clover and alfalfa for our supply of protein and this clover and alfalfa must of necessity be of prime quality and I mean by this, that it should be cut at a time when it has reached its greatest feeding value—earlier than my neighbors are wont to cut theirs—and it should be handled in a manner to save the leaves. It should be cut early and put into cocks when wilted fairly well, not only to save the leaves, but to prevent the sun drying it out. Will not attempt to explain to you why hay so cured excels in feeding value, but experience has proven such to be the case. Now I have spoken of growing *clover*, and have done so mostly for the sake of variety because alfalfa is far more profitable and much superior to clover for our purpose. Mind you, I want the cows to have a change to clover of the right kind that they may not tire of the generous feeding of alfalfa and silage, because alfalfa heads the list. Fix the fact in your minds that we are to grow the maximum yields of corn, clover and alfalfa through the most careful selection of seed, the most thorough preparation of the seed bed, in soil that has been supplied through the application of the liquid and solid voidings of our animals with plant food, and then by approved methods of cultivation. Now returning to the point that I hope to make clear: The three main feeds are very bulky. There is a limit to the capacity of a cow's rumen, and to the energy that she must employ to keep it working. We may choke the machine and cut down its capacity. To reach the assimilative capacity of a cow she must have the required amount of fats, carbohydrates and protein in about the right proportions and in the three feeds mentioned, the excessive amount of dry matter renders it impossible without the aid of concentrated feed like oil meal, cottonseed meal or the like, abounding largely in protein. I have tried to avoid the use of scientific terms likely to confuse the average farmer. In other words the cow can not eat, digest and assimilate an amount of these three bulky feeds sufficient to enable her to appropriate for the manufacture of milk in the largest possible amount. Cows differ in this characteristic, each cow being a proposition within herself and for this reason in order to get the best results from each and every cow in the herd it is necessary to feel an interest in the work and live very close to the cows. The good feeder will closely watch the trough, the eye, the coat and the voidings of his charge and soon experience a fascination for the work. Imagine the keen delight that Mr. Gillett experienced in making Colantha 4th's Johanna yield more than 27,000 lbs. of milk in one year. I derive much satisfaction in the unquestioned record of Jacoby Irene, the cow that will soon complete the third year of a continuous record having produced in thirty-five months the equivalent of 2,613 lbs. of butter. Similar results will reward those who will put their best thought and their heart into the work.

With the hope that it will prove an inspiration to some young man present with a liking for a dairy cow, I will briefly tell of how a son of poor parents was permitted to remain out of school and idle his time away on the streets of the little village where I make my home. He is a worker by inheritance, but saw nothing that he could do in our little quiet farm town, so I took him to do little errands. I made a cow man of him of the first rank. I taught him to appreciate the little things that influence the work of a cow. I have seen him so interested in the results that he would cry when his cows were down in their milk, and I have yet to see the person who could get more milk from a cow. He grew in usefulness and I secured a place for him where he now lives amid beautiful surroundings. He has made some exceedingly creditable records and it is rumored that he is bringing on a cow that will make the best of them look well to their laurels. This young man has not had the benefit of even a common school education, but has learned to cater to the whims of his cows. How I would like to see a scientific education combined with his "horse sense" and his love for a cow. I again refer to that feeding question, wondering if I made it clear why I want to leave the big coarse stalks and the big round cob out of the silage. Why I plead for the early cut clover and alfalfa cured under caps and urge that it be made to grow as thick on the ground as possible, that we may have the small fine stem instead of the large woody stem.

About the kind of cows with which we expect to get the best results: Unlike many breeders of pure bred cattle I feel able to look the proposition square in the face. I like all the special purpose cattle—dairy and beef. For our purpose it is folly to consider any breed of beef cattle. There are good and indifferent cattle in all the pure breeds and in all our dealings with cows I urge that we consider them as individual propositions. If the Ayrshire appeals most forcibly to your personal fancy you can accept her with the full assurance that well selected specimens will prove profitable under proper conditions and this statement will apply to the other breeds. If you have a weakness for the soft and pleasing colors of the Guernseys you can find a market for her product that will add zest to your enthusiasm. Her milk is especially high colored and she is a very economical producer. To an admirer of the breed I would say that she would be second in profit to no breed for his particular use. The Holsteins are enormous producers and if you like the massive blacks and whites they will do the work with possibly a trifle more indifference to conditions. You may have to do a little more work for your money. Select the breed that you like. Personally, I am well fortified with reasons for the faith that is within me. Life is too short and too strenuous to make new breeds or to dairy with cows not of dairy temperament. I would say to the beginner buy a son of a very superior cow. Go your length on a bull. If you must curtail expenditures do it elsewhere. In the selection of a dairy bull I likely differ from some present. I recall reading the views of a splendid authority recently not fully in accord with mine. The first bull that I owned was the son of a cow with a large record that I believe to have been true but of indifferent type notwithstanding having won highest honors at the great St. Louis Fair when at its best. Individually, he did not please me, but I was after records and bought the bull on records. It took ten years to recover from that deal. Records are still selling a lot of bulls that will do no better. I now look for a cow that is a superior individual—briefly the cow that is deep, long and wide of body with an udder that extends from near the vulva in rear to near the navel in front—smooth and symmetrical and closely attached to body; ornamented with four teats of proper size set wide apart; a cow of striking personality; hips prominent and wide apart; neck thin and slender and with a head indicating intelligence of high degree; last, but not least, that she have large, long and tortuous milk veins, and still better if her udder is well decorated with them. A cow of this type has never deceived me through a son if I can grow that son. You may have discovered this cow in some neglected spot and there may have been something in her early life that interfered with a record. She may never have been afforded an opportunity to show her latent powers but is a neglected example of the relation of form to function. Where all these signs of maternity are present there is little to fear, but on the other hand I have seen cows lacking in dairy conformation able to make a large record but unable to endow their progeny with their dairy temperament.

I hope to be able to show you plans of a very modest and inexpensive stable suited to a herd of any size, one that can be added to at any time without affecting the general arrangement; the most effective in keeping cows clean and providing at the same time for the greatest degree of comfort. It will make bedding go further than any plan known to me and at same time insures a good bed where needed and not behind the cow. It renders the cleaning of the stable more agreeable than any form seen in my travels. It can be built to serve the purpose by a saw and hatchet carpenter and yet so elastic in this feature that the same principle can be employed and admit of the rich man making it just as elaborate as his fancy prompts. It will save feed over any form met with in my experience. It will admit sunshine as no other plan does. It is not patented and is so plain that it will not appeal to any save the man hampered by lack of means. While here I will be glad to explain to any interested. In visiting breeding plants and farms from the New England States to California I have been struck with the force of a remark that I once heard a real estate man make in speaking of the dwellings and other buildings of farmers. In commenting on so-called improved farms he referred to the buildings and arrangements as "models of inconvenience." During the past three days you have listened to so many good things that in nearing the conclusion of this splendid programme I feel that I should thank one and all for kindly bearing with this test of your patience in listening to this paper of a "moss back" Missouri farmer.

THE VALUE OF THE SILO.

(By C. J. W. Jones, Roanoke, Mo.)

In 1905 my son and I, without skilled help, built a concrete silo 16 feet in diameter and 40 feet in height. We have filled this silo four times and we have had splendid results. The method and cost of construction was written for Hoard's Dairyman and was published by that paper at the time of construction and has been republished by that paper twice since. This silo stands as perfect as when built and it is believed would endure for centuries with but little repair.

This silo has no roof and when we fill it we pile on top all that will lay on. Indeed, this year we placed some weather-boarding on top and thus gained several tons of silage. Filled in this manner it will hold 200 tons. Last year it took just ten acres of drilled corn and cowpeas to fill it. I give you some comparisons of value of this 10 acres of siloed corn.

The basis of comparison is taken from a table of nutrient equivalents given in a recent number of Hoard's Dairyman. The 200 tons of silage from this ten acres was equivalent to 70 tons of timothy hay, which at $8 a ton would be $560 or to $56 an acre for the silage and at one and one-half tons to the acre—a large crop for Missouri—would require 45 acres to grow the hay.

This 10 acres of silage was the nutrient equivalent of 1,420 bushels of corn, which at 60c a bushel would be $850, or $85 an acre. It would require 35 acres of ground to produce it at 40 bushels to the acre.

Again, this silage crop equaled in value 58 tons of bran, which at the present value would be $1,400, $140 for each acre.

Once more, this ten acre silage crop was the equivalent of 45 tons of cotton seed meal, which at $30 per ton, equaled $1,450 or $145 an acre for silage.

A farmer adjoining me owning an 80 acre farm wished to buy 20 acres from me, but I advised him to put up a silo and he would have larger return from his 80 acres than he could get from the 100; however, he has not done it. Sometimes a Missourian requires a good deal of "showing." These are some of the values of silage:

1. It stores well. When properly housed it will keep with less wastage than corn or oats in the crib or hay in the stack. It also keeps longer.

2. It is harvested when corn (the greatest food plant that grows) has reached its utmost development. When nature can put no more into it and before she claims anything back out of it, then it is cut and stored and sealed for future use. It is put away in its own juices and is so soft that even the cob is thoroughly masticated and thus digestion is easy and most complete.

3. Cows eat it greedily. "The proof of the pudding is in the eating of it."

4. It corresponds to the nature of the cow. It is a bulk feed. Cows have big stomachs. They were made for grass. The corn plant is a big grass and cut up fine for her in the form of silage. It makes her winter ration most like her summer blue grass. Concentrated condensed feeds contract the stomachs and must work a very radical readjustment of the internal cow, but concentrated feeds can be fed with great advantage mixed with the bulkier silage.

5. There is absolutely no wastage in feeding when judiciously fed. I feed my cows from 40 to 50 pounds of silage each daily and they "lick the platter clean."

6. There is practically no waste in harvesting; the stalk, the blade, the grain, the cob, the tassel are all utilized. The usual method is to save the ear and largely waste the rest of the plant.

7. It is the best solution of the problem for the drouth and short pastures of summer. It is a fine substitute for bare pastures, and the farmer forearmed with a few acres of corn in his silo is safeguarded against drouth.

For these and many other reasons I especially commend the silo to dairymen and also to farmers on small farms. It seems to me an absolute necessity to the success of the dairyman. It multiplies the possibilities of the small farmer. Instead of his attempting to rent more land, or buy more land at $100 per acre, let him, with the silo, make his 80 acres double its product. Then he will know how to make $100 land produce a profit.

In conclusion: From that ten acres of siloed corn I fed, from the 1st of November till grass came, 30 cows and 15 head of fall calves; and from the 1st of March, 20 head of yearlings, and after all that when grass came I still had four feet of silage left. How else could I have gotten so much feed from so little ground at so small a cost? In coming down from Centralia on the Wabash I was talking with a lady who informed me that a man near Springfield, Mo., built a 400 ton silo a year or two ago and more than gained the cost of silo in the first year's feed. This speaks for itself.

THE DAIRY COW AND HER REQUIREMENTS.

(By I. T. Van Note, Herdsman, Missouri Agricultural College Dairy.)

When we speak of the dairy cow we speak of an animal whose mission in life is to produce milk. Her value is measured by her ability to produce a paying quantity of milk in one year. In order for her to do this, she must be a persistent worker. A question now arises in our minds as to the kind of an animal it takes to perform this duty. We may differ a little on this, but I think that our ideas are getting to be about the same. In late years we have learned a great deal about the dairy cow.

I will give you in brief my idea of this animal. She is angular and spare fleshed; has a broad muzzle and heavy lips; head, clean and all lines distinct; eyes, full and oval—flashing with energy and intelligence; ears, medium and showing good secretion; neck, lean and length in proportion to size; shoulders, thin at withers and loose, wide at lower points; chest, deep and wide; barrel, long and wide, well supported by heavy muscles; ribs, well sprung, of good length and showing good spacing; loin, broad and not too thick; hips, broad, flat, and of good length, with hooks and pin bones well apart; udder, large, well attached, extending well forward along the barrel; hind quarters, broad and reaching well above the thigh ovals; mammary veins, large and tortuous, entering the cavity through large wells; legs, of medium length, strong and well placed under the body; size, large for the breed.

The dairy cow is not a product of an accident, but is an invention of man, as much so as is the dynamo, circular saw or steam engine. Her success in life, like the mechanical inventions, depends largely upon the wisdom and experience of her keeper. Her keeper should have a natural liking for his animal. He should know her in a physiological way, should be quick to learn her likes and dislikes, her pecularities, know how to teach her to have confidence in him. These are points that should be well considered, especially among the heifers that have just come in milk.

Next in consideration would be her feed. This is of importance, but of no more than a great many other things that must be done in order to have her do her best. In her feed we furnish her with material for building tissue, for heat, energy and making milk. In order to supply these demands, she should be fed a balanced ration, that is, a ration that carries digestible protein, carbohydrates and fat in proper ratio and in the most accessible form to supply all requirements with the least possible energy.

The concentrates should be well ground, and hay and silage should be properly cured and put up to contain the greatest amount of digestible matter. Hay for dairy cows should never be left standing until over-ripe, nor left to cure too long in the sun. Mouldy feed should be avoided. The feeder must be the judge as to the amount fed. This is especially true with the cow that has just freshened. Highly concentrated food should be withheld for three or four days, and then given in small quantities, and watched close at this time. Udder troubles are often the results of bad feeding. Never leave it to the cow, as she will eat according to her appetite, regardless of what she actually needs.

Along with good feed, she needs abundance of pure water, not too warm nor too cold, and furnished her in a clean tank or bucket.

Sunlight and pleasant surroundings are great factors in stimulating milk secretion. Her stall should be provided with abundant sunshine, her view should be unobstructed, as she is an animal that wants to see everything she hears. The lot should be kept clean and free from mud and manure, her pasture should not be too large and all brush and weeds kept mowed. She is an animal that follows in the wake of civilization. She never goes ahead. Conditions must be made suitable before she is of any value to speak of.

Kindness is a virtue that should never be overlooked. Her maternal disposition is of a high character, probably the greatest of any dumb mother. In our care for her she understands us. Grooming to her is a great satisfaction. The friction of the brush and comb is a pleasing and stimulating way of showing kindness. A gentle stroke of the hand while in the lot or pasture has a great influence in creating confidence in her for you. I believe where kindness is most appreciated by the dairy cow is at the time of drawing the milk. I have seen milkers sit on a stool with a bucket between their knees and pull the udder from its natural position in order to get the stream of milk to hit in the bucket. I have seen others pull down on the teats until they looked like a piece of elastic. I speak of these practices because I know they are altogether too common. The milk should be drawn carefully; the milker should sit so that the pail can be milked in with the udder in a natural position. The teat should be taken in the full hand and the pressure gentle and just enough to force the milk from the teats.

Milkers who do other barn work should wear gloves or mittens, I prefer such as you buy three pairs for a quarter. This keeps the hand soft, does away with cracked and chafed hands, makes them easy to wash and clean and affords a great deal more comfort to the cow than the rough calloused hand. The milker should keep the finger nails trimmed short. I have known cows made kickers by milkers who milked with long finger nails.

Our success depends largely on the faithful execution of our duty in the small details that are required in caring for the dairy cow.

PROFITABLE FEEDS FOR THE MISSOURI DAIRY COW.

(By Jas. N. Price, Trenton, Missouri.)

Among the important things to be considered in the feeding of dairy cows are the composition, palatability, variety and cost of feeds. The ration should be made up of such feeds as will furnish the required digestible nutrients in the proper proportions to maintain the body and produce a profitable flow of milk.

Palatability is essential in a ration because unless the flavor and condition of the ration is pleasing to the appetite of the cow she will not consume sufficient for profitable work. Palatability also aids digestion by stimulating the flow of saliva and other digestive juices. We find that individuals in the herd differ in their likes and dislikes for foods. These individual peculiarities in eating should be recognized and catered to by the feeder. The cows should be fed as individuals and not as a herd.

Variety, like palatability, increases the consumption of food, and therefore the flow of milk is increased. In fact variety makes a ration more palatable. Animals will always do better when a variety of feeds is furnished than when confined to one kind of grain throughout the season.

The cost of production must always be considered. The profit in dairying results from the difference between cost of production and selling price of milk or butter.

While it is always important to secure as high a price as possible for your milk and butter, it is still more important to strive to reduce the cost of production without lowering the grade of your product. This can be done by reducing the cost or increasing the efficiency of your ration.

In determining the best ration to use for economical production of milk and butter we must consider both the composition and the cost of the feeds to be used. It is not always the feed that costs least that will produce milk and butter at least cost. It is not an act of economy to feed corn and cob meal as the only grain with corn silage and corn stover as roughage simply because corn and cob meal cost only 40 cents per bushel when wheat bran costs $1.20 per 100 pounds. The straight corn ration will not produce enough milk to make dairying profitable nor will it even nourish the body properly; while the addition of wheat bran or cottonseed meal to the ration, although it increases the cost of feed per day, will increase the flow of milk enough to more than pay for the extra cost of feed.

The economy of a ration depends, therefore, not upon the actual cost of feed per day, but upon the cost of producing a gallon of milk or a pound of butter.

To illustrate this point, let us consider the value of the Missouri ration of corn and timothy as compared to a ration in which some protein feed is used as a supplement to corn.

Here is a dairyman who has raised timothy hay and corn this year and thinks he cannot afford to use any other feeds because they are too expensive. How is he going to succeed in economy of production? If he believes in a liberal allowance of feed (quantity and not quality considered) his ration will likely be about as follows: 15 lbs. of timothy hay; 10 lbs. of corn stover, and 8 lbs. of corn-and-cob meal. This ration will furnish enough protein for only 4 or 5 pounds of milk although there are carbohydrates and fat enough for 30 or 35 pounds of milk. We cannot, therefore, expect a cow receiving this ration to yield much more than 4 or 5 lbs. of milk unless she does it at the expense of her body.

This ration at present prices will cost about 11¼ cents per day; and if the cow produces 6 pounds or ¾ gallon of milk it will cost 15 cents per gallon of milk.

Now, suppose we substitute wheat bran for corn-and-cob meal, using the same weights of grain and roughage as before. This ration of 15 lbs. of timothy, 10 lbs. of corn stover and 8 pounds of wheat bran will furnish protein enough for about 12 pounds or 1½ gallons of milk. The ration will cost 15 cents per day but will produce milk at 10 cents per gallon.

The carbohydrates are still in excess of the protein, so let us substitute 15 pounds of clover hay for the timothy, which is not much of a dairy feed, anyway. This gives us a ration good for about 20 lbs. of milk. It will cost 15 cents per day the same as before but produce milk at 6 cents per gallon instead of 10 cents. Why, then, wouldn't it pay to sell that timothy and invest the money in clover hay? And some of the corn and invest the money in wheat bran or cotton-seed meal?

This does not mean that if a cow is fed 15 pounds of clover hay, 10 pounds of corn stover and 8 pounds of wheat bran she will give 20 to 25 pounds of milk. That depends on the cow and the time in the period of lactation, but it does mean that a cow yielding 20 to 25 pounds of milk should receive digestible protein, carbohydrates and fat in about the proportion furnished by this ration if she is expected to keep up her milk flow. One great mistake of dairymen the country over is to feed all cows in the herd the same amount of grain regardless of milk production. To produce milk economically, the dairyman must know how many pounds of milk each cow is giving and feed her accordingly.

It requires a certain amount of feed to maintain the body and the cow should receive sufficient feed above this amount required for maintenance to enable her to produce a full flow of milk. If she is not given sufficient feed to maintain her body weights and to produce a full flow of milk she will convert her surplus flesh into milk. This process cannot be kept up indefinitely, however, and the cow soon shrinks in milk flow until she yields only in proportion to the feed received. On the other hand, if a cow is fed in excess of what she requires for maintenance and milk production, the surplus will be converted into body fat.

A cow should be fed so that she will produce a full flow of milk and maintain practically the same body weight.

There is no doubt that the dairyman should produce most of his feed on the farm if he wishes to produce milk economically. The proper feeding of dairy cows and the maintenance of the soil fertility go hand in hand. Those crops which should be grown on the farm to maintain and improve the fertility of the soil produce that class of feed necessary to furnish a properly balanced ration for milk production.

The custom on many of our Missouri farms is to raise grain continuously or in rotation with timothy hay, and the cow receives timothy hay from the hay "bunk," corn stalks in the stalk field, straw from the straw stack and a few little "measly nubbins" night and morning to make her stand still while Ma or one of the girls does the milking.

Such methods are injurious to the soil, to the dairy cow, and to the financial condition of the owner.

The maintenance of soil fertility and the proper feeding of dairy cows demand a system of crop rotation including one or more legumes, such as clover, cowpeas, soybeans, or alfalfa.

The value of clover is recognized by many farmers, and should be grown whenever possible. In some sections of the State clover cannot be grown successfully; and in such cases the cowpea offers an excellent substitute. The cowpea yields a larger amount of hay per acre, that is equal if not superior to clover in feeding value. In Bulletin No. 73 of the Missouri Experiment Station the average yield of cowpeas per acre in Missouri is given as 1.6 tons, while the average yield of all other hay crops is 1.2 tons; a difference of only a little less than ½ ton in favor of cowpeas. The same bulletin states that the average crop of cowpeas is worth more per acre than the average crop of corn. Besides producing a crop equal to or more valuable per acre than corn, the cowpea improves the soil and enables us to grow better corn, while a crop of corn reduces the fertility of the soil so that each succeeding crop yields less than the one before.

The soybean is not so well known in this State, but deserves more attention.

In recent work at the Tennessee Experiment Station an acre of soybeans produced more beef and at less cost per pound than either an acre of corn or an acre of cowpeas.

In feeding trials conducted by the writer during last winter at the Tennessee station soybean straw and soybean meal fed in proportion as they were grown in the field proved superior to alfalfa hay as a supplement to corn silage and corn and cob meal for milk production.

I am better acquainted with the growth of the soybean in Tennessee than in Missouri, yet it seems to me that it should do equally as well in Southern Missouri as in Tennessee and should be successfully grown throughout the State.

In Tennessee the soybean adapts itself to late planting better than the cowpea, and for that reason it seems that it would be better suited to our short season or as a catch crop after small grain. It yields as much or more forage than the cowpea and yields more seed. The entire plant cured as hay is about equal to alfalfa hay; the threshed hay is superior to corn stover, and the beans ground in meal are equal to cottonseed meal for milk production. Alfalfa is now being grown in many sections of the State and promises to become a general crop with us. It furnishes one of the best feeds for all kinds of stock, and should be grown wherever it is a success.

A system of cropping in which clover is used as the main hay crop and corn the main grain crop and cowpeas as a catch crop between the main crops of the rotation should prove successful in this State. The cowpea can also be sown in the corn at last plowing and will make fall pasture after the corn is removed from silage or can be plowed under as a green manure crop.

If the corn is being grown for silage cowpeas may be drilled in beside the rows of corn and harvested with it and put into the silo. This combination makes an excellent silage. Allow me to emphasize the value of silage in the dairy ration. The silo has not been used in this State as generally as it should be.

The greater milk flow during the spring and early summer is due to the succulent nature of the grass. Succulence gives to a feed a feeding value above the actual digestible nutrients it contains. This value is due largely to the better condition of the digestive system, which keeps the animal in better health. Silage will furnish succulence to the winter ration insuring better health of the herd and a better milk flow than with dry feeds. Silage reduces the cost of feeding, since it furnishes the bulk of the ration and costs only about $2.00 per ton to produce and put in the silo. The advantages of silage may be stated as follows:

1. It furnishes a succulent feed in winter which is beneficial to the health of the herd and increases the flow of milk.

2. It saves a large amount of feed which ordinarily goes to waste in the stalk field.

3. The use of the silo is the most convenient method of caring for the corn crop, and silage is easily and conveniently fed to the cows.

4. There is scarcely any waste in feeding silage of good quality. If not over-fed, cows will eat it up clean.

Corn is the most common crop used for silage, but sorghum is used to a considerable extent. Cows seem to relish sorghum silage a little better than corn silage and the feeding value is otherwise about equal. A mixture of corn or sorghum with either cowpeas or soy-beans makes an excellent silage. The cowpeas may be planted in the corn or sorghum and harvested with it; but the sorghum should be grown separately and the two crops mixed while filling the silo, since the soybean will not grow well if shaded.

If the corn is to be grown for silage on rich land it should be planted a little thicker than ordinarily, so that the stalks will not be too large. It will give a better yield of silage per acre and there will be less waste in feeding. Do not plant too thick, however, or you will reduce the yield of grain, thus decreasing the feeding value of the silage. So much for the subject of raising feeds; but how shall we use the feeds we now have on hand? That is the question that is up to us today. We cannot raise any clover or cowpea hay until next summer, and if we did not grow them last summer we will have to depend upon the market for our protein feeds. If you have timothy hay sell it and buy clover or cowpea hay. The clover will not cost you any more than you can get for your timothy, and sometimes not so much. Cowpea hay may cost you a little more. If you cannot buy either clover or cowpea hay of some of your neighbors it will pay you to buy it on the market, even at more per ton than you get for your timothy. Alfalfa hay can be bought at points in Kansas for $10.00 per ton in carload lots. The freight on a carload will make the hay cost you about $15.00 per ton. You can afford to pay this price rather than feed timothy hay alone for roughage.

Alfalfa is equal to wheat bran in feeding value, and the bran costs $24.00 per ton. Cottonseed meal and wheat bran may be substituted for part of the corn. They will improve the ration and add variety. The following rations will give good results with the average Missouri herd:

1. Clover or cowpea hay, 10 pounds; silage 30 to 40 pounds, and a grain mixture of equal parts of corn and cob meal and wheat bran or oats; or of corn and cob meal three parts and cottonseed meal one part, fed at the rate of 1 pound of grain to 3 pounds of milk.

2. All they will eat of clover or cowpea hay and a grain mixture of five parts of corn and cob meal, three parts bran or oats; or three parts corn and cob meal and one part cottonseed meal, fed at the rate of 1 pound of the grain to three pounds of milk.

3. All the alfalfa or cowpea hay they will eat and 1 pound of corn and cob meal to 3½ pounds of milk.

If you have corn stover allow the cows to have access to it through the day or combine it in small amounts with any of the rations given.

MY EXPERIENCE IN BREEDING UP A PROFITABLE DAIRY COW.

(By Wm. H. Bruns of Concordia, Mo.)

My first stock was Shorthorns. I read about the high prices they brought in New York, so I obtained a roan bull calf. His calves were nearly all roans, so I thought good calves would result.

They gave good milk for about five or six months. Some of them did not give enough to raise a good calf. Then I began to look around for something else. One day in August my wife and I went to see one of the neighbors and took dinner there. They had some butter on the table that stood up straight on the dish. Our butter would do that when first brought out of the cellar, but would soon melt down. I inquired the cause. The lady answered: "We have an old black kicking cow that is the cause of that; I can't milk her." I inquired if I could get a heifer calf of that cow. "No," she said, "her relatives had already spoken for more calves than the cow would ever have." But in a year or two this family had a sale and sold off everything, so I bought that old black cow and bred her to a Shorthorn bull and raised three heifer calves, but not one of them had milk or butter like the old cow. I then learned that the calf would take more after the sire than the dam, in the matter of milking qualities.

After this experience I bred my cows to some Galloways, but still failed to get good milkers. Then I got some Ayrshires. They did very well, but I became afraid of them. We did not know how to take off the horns, or I would have kept on breeding them. By the way, I want to say here that cows now have no more need of horns in this civilized country than a man has need of a gun in church. The horn ought to be killed the first day the calf is dropped. A drop of caustic potash or common lye is good for this purpose.

I then went back to Shorthorns. Again I was told that there was a strain of Shorthorns that were good milkers. I bought a roan cow, and though she was thirteen years old she raised five calves for me. One heifer calf, with a sire of good milk stock, developed into what I thought was a good milker. Then our creamery started up at Concordia, and a man there offered to test my milk for me. It tested just two per cent. I was told that a good cow ought to test four per cent, so I found again that my work had been useless.

In 1893 the dairy test started in Chicago, and I watched Hoard's Dairyman, which gave a correct account of each cow. The Jersey Bulletin also charged each cow for what she ate and gave credit for the butter she made, so I saw that the Jerseys made butter cheapest, for the butter of the Jersey breed cost less per pound than the other breeds. There were twenty-five Jerseys, twenty-five Holsteins, twenty-five Shorthorns there; the best cow, a Jersey, made $73 clear profit in six months, so I thought I would breed up in Jersey cattle. I procured a pedigreed Jersey bull and bred him to my Shorthorns. The first cross proved to be a paying cow. Our first cows made an average of 140 pounds of butter a year. Our half-blood Jerseys made 250 pounds a year, and now our herd averages over 300 pounds.

You can see my mistakes in trying to get a good paying cow, and my success in breeding a good paying cow. The main thing in breeding is a good dairy sire. "The sire is half the herd," is the old saying, but I think the sire has three-fourths of the power to increase the value of the herd, and right here is where the secret is that so many fancy breeders do not understand. The dairy cow has two purposes—one is the milk and butter-fat she will produce, and the other is the traits she will hand down to her offspring; the first dies when the cow dies.

But there is no inherited value in the single-purpose cow. There is no certainty in the heredity of the scrub. That is the reason why the special dairy cow of the thoroughbred foundation breeding is worth more money than the cow that would be equally productive but does not hand down her characteristics to her offspring. A cow with a record, a tested cow that will make two pounds of butter a day and over, is the kind of a cow that you want to breed, and sired by a bull that is out of a good foundation breeding. Then you may be sure you are on the right road to success in breeding up a paying herd of cows, and as our land grows in price so must we raise our standard of butter production. Don't be afraid that it will be overdone or that it will not pay on high-priced land. On Jersey Island and Guernsey, land is worth from $600 to $1,750 per acre, and they have a cow to every acre of land. There they take the best care of them. We don't think enough of our cows, nor do we take good enough care of them. They furnish the best produce on earth, the best drink there is, a balanced ration for man, and should, therefore, have the best of care.

HOW I MAKE MONEY DAIRYING.

(By S. H. Pile, Glasgow, Missouri.)

My talk will be more on how I spend money dairying rather than how I make money. However, I believe and hope I am on the right track and eventually will have some money. Here, at the Experiment Station, the foundation herd of cows was just ordinary stock, while today they have a number producing over 700 pounds of butter per year. Such cows are valued at perhaps several hundred dollars. This gives me encouragement, and I have aspirations that in time I can produce just as good by following the same methods of breeding, testing, selecting, feeding, etc.

The money-making dairy farmer might be one of two kinds. He might spend neither money nor time to achieve greatest results but put up with old and inadequate buildings, poor cows, cheap feed, and refuse to test because it takes time and necessitates spending some money for a testing apparatus. He gets along with very few farm implements, and economizes in every possible way. He never spends a dollar except for something absolutely necessary. Is this making money? We have neighbors who rarely ever sow clover seed because they are afraid they will lose the seed. It is almost useless to add that in time they and their farms get so poor that they can't buy seed if they want to, because they haven't the money. We have other neighbors, who, by close and careful economy, by never spending a dollar for anything short of dire necessities, have taken good care of their land, have invested and loaned their money and have accumulated quite a sum.

One old gentleman of this sort was remonstrated with by his wife for not buying sufficient harness for his teams. He replied, "By George, harness cost money. Let the men tie the old ones up with binder twine." His team sometimes ran away because the lines were not strong enough to hold them if they became frightened, yet I suppose he considered it economy to spend no money for better equipment.

Another man with a fine four-hundred acre farm owned but one pitchfork, depending on borrowing from neighbors when he needed more. He was afraid to hire anyone to husk corn or stack hay for fear they wouldn't do the work right, or was too stingy to part with his money. He thus allowed much of his farm to grow up in brush, because afraid to rent to anyone.

We often see the economical dairy farmer who thinks it a waste of time to read or talk about his business, who refuses to buy books or subscribe for papers devoted to his calling, and gets along with a scrub bull and worse than scrub cows. This man often gets back 39 cents for each dollar's worth of feed, and works for nothing, boarding himself. He is the man the President has been inquiring about, desiring to make his condition better. It can be done by waking him up. He is no better nor no worse than those people in the towns and cities who barely make a living.

Now, we do not make money in any of the ways mentioned, for we do not think them the best way. To acquire the greatest results is our aim, and we do not hesitate to spend money to help accomplish this. Our farm is five miles from town, the road is quite hilly and sometimes gets very muddy. Ours is a great stock feeding community, therefore but little of the feed raised near-by is offered for sale. To save hauling, time and money, we try as much as is possible, to grow all the feeds we need on our own farm. Corn is perhaps the cheapest feed and is usually grown in the quickest time. We have a brick and stone silo that cost $700. Have a silage machine, a ten horse power steam engine and all the accessories which have used up all our money. We paid $3.00 per bushel for seed corn, having every ear tested for its germinating qualities. We do about three times as much work in preparing the land and at least two or three times as much cultivating as our neighbors. Some years I think it pays—some years I don't know, but have a fool idea that good farming will pay in the end.

Our second crop in importance is clover, but we usually have more acres of clover than corn. We try to cut the hay early and sometimes get a profitable seed crop afterward. In about twenty years' experience in farming I have had a very few failures in getting a stand of clover. The few times have hurt, but the many successes have been glorious. I often sow a little timothy with the rye or wheat in the fall to make a heavier sod, if I expect to pasture, and then sow clover in the spring.

Cow peas are another valuable crop in case we are short on clover, and many times I have sowed them in every unoccupied corner, in the corn on thin land, and elsewhere, and think it has always paid. One winter our cows had nothing but cow peas and corn and we got fine results—as much as the previous winter when we had to buy bran and cottonseed to balance up with corn and stalks.

Alfalfa is another valuable crop, but we haven't begun to grow it very largely; however, we believe that in time we can make it the best farm crop for dairy cows.

We think it wise to grow all our feeds, yet when necessary to balance the ration we do not hesitate to buy. The question of feeding economically is as great as farming economically. The man who contended his cow could live on fresh air didn't quite succeed, because she died about the time he got her down to one straw a day. No doubt he was feeding economically, yet it didn't pay. We have various tables showing analyses of feed stuffs; we work out a ration that we think best, then usually have two or three authorities criticise same. We use our best judgment, study the capacity of the cow, weigh and test her product, then feed accordingly. We make mistakes, lots of them we never know, no doubt, yet in the main we are constantly increasing our herd; our land is getting richer; we are getting more buildings, more and better equipment, etc. Whether this is economical dairy farming or not I leave for others to say. We have no bank account beyond our everyday needs; no money loaned out; no bank stock; no railroad bonds. Yet it is as much satisfaction, perhaps, to see our nice heifers, colts, fat pigs, and to know that we are trying to carry on a progressive and up-to-date line of work, even if we can't count our profits in dollars. To farm economically is much like any other business. One must spend money to make money. A good building, a fine bull, a valuable mare, will often pay more than 6 per cent on the investment.

We sell much of our product at retail and believe in advertising. We have been able to sell our product more readily and at higher prices because people knew about us from seeing our advertisement and had confidence that they would get what they wanted and needed.

Economy in labor is practiced by many. I have been accused by some of making fools of the hired help of our community because I pay higher wages than any one else (and regret often that I can't pay more than I do). I go on the theory that by paying more, the thrifty, intelligent and steady men are attracted to me on account of the extra wage. By having plenty of men, by doing our work on time, I have more time for planning and making improvements, more time to devote to selling the products; do not need to keep myself constantly grinding, and can rest easier and more content knowing that my work is being done properly, because my help is reliable and trustworthy.

Nobody would willingly burn up a ten-dollar bill unless crazy or a fool, yet many dairy farmers, and others, waste this much and more every month by not properly caring for the manure. A little more care, a little more work, would work wonders. I once heard T. B. Terry say that he was confident his manure and method of handling it paid or saved him at least $100.00 per year over and above what his nearest neighbor realized, and this, alone, in twenty-five years amounted to $2,500—to say nothing of the interest on it—which would have more than doubled it. $5,000.00 is a nice little competence for old age, and worth saving. I have often thought of this, especially when passing a farm near us which is divided by a creek. On account of convenience of water and other reasons, this man's feed lots and barns are located along this creek. He has been a large feeder of cattle, mules and hogs for at least fifty years. They make butter, raise poultry of all kinds and all the manure goes off down this creek. If he had the value of this manure in the bank or in the increased fertility of his farm, he would have been able to wear diamonds as big as walnuts, instead of being just fairly well-to-do. I presume he thinks he is practicing economy because he doesn't have to hire any manure hauled, the spring rains thoroughly cleaning up all his feed lots without pay or board.

The dairy farmer has no business to loaf every Saturday around town, nor spend time swapping lies or horses; because the cows must be milked, the butter made, or the cream delivered, rain or shine, hot or cold.

Your Secretary wrote me to dwell more particularly on what feeds to grow and what to buy. Each man can best work out this problem according to his soil and seasons. I have tried as best I could to tell how I hope to make money dairying.

Another essential for successful dairy farming, and to keep it running in the proper manner, is to have a clean woman somewhere near the balance wheel, to keep things bright and shiny, or else the accumulation of dirt and cobwebs is sure to over-balance any effort that we men might make. A dairy farm should also have boys and girls growing up along with the business, or else it is apt to go down hill as we grow old. Yet it is not wise to try to grow high priced cows and cheap boys. I am endeavoring to teach my boys to know more and do better and gain by my experience. These boys are only seven and nine years old, but the firm name is "S. H. Pile & Sons, proprietors of Seven Hills Dairy Farm," and I hope to have it remain thus. I want to educate these boys for the farm, instead of away from it, as so often happens.

There is more in life than the mere accumulation of dollars. We want to keep ourselves bright and young as long as possible, to be able to enjoy some of the pleasures and luxuries of life, to leave behind us better men and women in our children than we are ourselves.

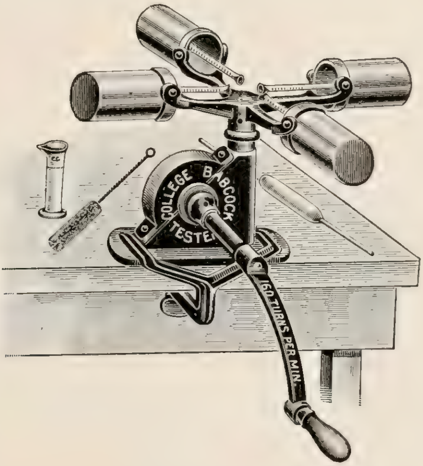
Wise spending of money, I believe, will result in greater returns than niggardly economy, and even if we do not hoard so many dollars, we will have had the satisfaction of keeping them in circulation.

One profitable cow will eat but little more than an unprofitable one. It may cost a little to find the right one, but it pays to do so. It may be necessary to spend some money to find the people who are willing to pay extra prices for good butter and cream, but the money comes back many hundred-fold. Clover seed, silos, machinery, all cost money, but not like high priced mill feeds. It costs to care for the manure, but think of the extra crops resulting therefrom. A good barn costs more than the "dome of heaven," but isn't the barn worth while?

THE BABCOCK TEST.

(By F. L. Austin, Secretary Missouri State Dairy Association.)

Any farmer can test his own cows with the Babcock test and learn definitely what they are doing. It is not a difficult operation, but, like all things that are worth while, it requires careful and systematic work. It takes but little time to make the test and a half dozen cows may be tested nearly as quickly as one.



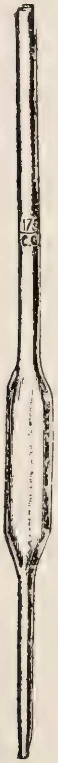
4-Bottle Babcock Tester.

The outfit necessary is as follows: For a six to ten cow dairy, one 4-bottle Babcock tester; four milk test bottles; 1 17.6 c. c. pipette; 1 17.5 c. c. acid measure; sulphuric acid and a number of glass jars holding the samples of milk. For a larger dairy than ten cows the machine should be a 12-bottle machine.

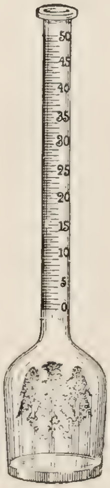
For taking composite samples a "milk-thief," or sampler should be included. This is simply a brass rod about a quarter-inch in diameter by thirty inches long. The sample is taken by inserting the rod to the bottom of the bucket and closing the top by placing the thumb or finger over it. A spring balance scale for weighing the milk should accompany the outfit.

SAMPLING THE MILK.

First, determine just what cows are going to be tested and make a list of them. Then prepare the jars for the samples by labeling each jar corresponding to the cow for which the sample is to be taken. Pint fruit jars make excellent containers for the samples. Plan to test each cow's whole day's product. Sampling may begin morning or evening, just so that one directly follows the other. For instance: Tuesday night's milk and Wednesday morning's milk or Wednesday morning's and Wednesday night's milk in the composite sample.

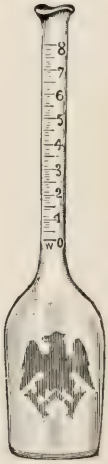


Pipette



Cream Bottle.

Acid Measure.



Milk Test Bottle.

When ready to take the sample the cow should be milked clean, and, immediately following the milking of each cow, the milk should be poured at least twice from one bucket to another and the sample taken at once. Use the "milk-thief" in taking the sample by inserting it to the bottom of the bucket, covering the top with the thumb, drawing out and letting it run into the proper sample jar.

MAKING THE TEST.

When ready to make the test have a kettle of hot water handy. The sample should be thoroughly mixed. This should be done by pouring from one bottle to another, letting the milk run down the sides of the bottle instead of in the middle or instead of shaking, either of which causes air bubbles to come in the milk which will make the test lower than it should be.

When the sample is thoroughly mixed, insert the pipette in the sample and draw the pipette nearly full of milk, being careful not to get milk into the mouth. Draw the pipette from the mouth and quickly clap the first finger over the top. Then let the milk run out gradually by lifting the finger slightly until it falls in line with the 17.6 c. c. mark. Place the lower end of the pipette in the test bottle as far as it will go and blow the milk into the bottle, allowing it to drain out well. The sample is now ready for the acid.

ADDING THE ACID.

The acid used should be commercial sulphuric, 1.82 specific gravity, which can be purchased at any drug store. Great care should be taken in handling the acid, as it is very powerful and quickly burns anything it touches. Its action can be counteracted by cold water. The proper amount to add to the sample of milk is 17.5 c. c. The acid measure is marked to contain this amount. In adding it to the milk, pour it down the sides of the bottle's neck slowly. Then mix with a rotary motion until the mixture is a dark color. It will ordinarily take on a dark purplish hue. Then let stand until all the samples are similarly prepared and place them in the machine and make the first run of five minutes. Be sure that the bottles are balanced in the machine. If there are but three samples to run, put a bottle of water in the machine, so as to make two bottles on a side, and preserve the balance. Keep up the speed of the machine according to directions given on the handle.

After the first run of five minutes add water nearly boiling hot to the bottom of the necks of the bottles and make a second run in the machine of two minutes. Then add hot water, the same as before so as to bring the butter fat into the necks of the test bottles so that the top line is not above the 8 per cent or 10 per cent mark and the lower line is not below the 0 mark. Run one minute.

READING.

Then read immediately. Do not let the tests stand for even a few minutes, for the fat will contract and the test will be less accordingly. The number opposite the lower point of the butter fat column subtracted from the number opposite the upper line of the butter fat column gives the reading and the proper test. A pair of dividers or an ordinary compass will be found handy for quick and accurate reading. Record the test in a record book where it will be used in connection with the amount of milk produced by each cow. This completes the operation. The glassware should be thoroughly washed with soap and hot water and rinsed with hot water and kept in a clean place ready for the next test.

THE DAIRY COW.

(By Hon. W. W. Marple, Chicago.)

A lawyer once said he would rather defend a guilty man than an innocent one, because if he lost the case he didn't feel so badly about it. This explains my situation exactly on this occasion. The most eminent surgeon never presumes to perform an operation on his own kin. His sympathy unnerves him and his fear of a mistake unqualifies him for doing good work, so I ask your indulgence tonight for any mistake I may make in presenting the claims of "The Missouri Dairy Cow," on the grounds of my close relationship to her and her keeper. A darkey was asked once if he could have three wishes granted what they would be, and without hesitation he said he would take, first, ten barrels of whiskey, then he would take ten boxes of tobacco, and then he hesitated for some time and said: "I believe I would take another barrel of whiskey." If I could have three wishes granted, in the interest of Missouri, I would make my first choice a dairy herd for each farm in the State; my second choice, a silo for each herd, and my third choice, a few more cows. I acknowledge as an additional cause for embarrassment tonight the personnel of this audience who demand a reason for the faith that is within them and I realize that the influence of your verdict will be felt far beyond the confines of these walls, and the ultimate decision of a question more important to this State than we can conceive will be materially affected by this verdict. If any further evidence of my position on the question of the dairy cow for Missouri is needed, I would say that I believe a failure to encourage the most generous introduction of dairy cows into this State is absolutely criminal, and that any citizen of this great commonwealth to whom has been given a position of trust, in any way discourages the development of dairying to the highest degree should be punished by eternal ostracism from the arena of politics; for my opinion tonight is exactly opposite to that of the boy who was one of a family of ten children, and who was called into his mother's room one morning to welcome the advent of the eleventh. He looked at the little fellow intently and with a serious expression for awhile, when his father said, "What do you think of it?" He answered: "Well, I can think of a good many things we need worse." I am honest when I tell you I can think of nothing Missouri needs worse than the dairy cow.

I am not here tonight to introduce the dairy cow to Missouri and Missouri people, for she is no stranger to this great State, but I come to you with a message of interest in her behalf because of what she has done and because of the rich promises she makes. I come to protest against unfair discrimination in favor of her brother and to demand recognition that will enable her to fulfill her promises and her keeper to reap his reward. I look forward to the time when her advocates, who have for years defended her and sung her praises, will be made to feel like the boy who in saying his prayers always prayed to God to bless Aunt Harriet and make her happy. One night his father was listening to him and he heard him pray for everybody but her. He said to him: "You forgot to pray for Aunt Harriet." The boy said: "She don't need praying for any more; she is engaged now." When Missouri, as a unit, has become engaged in dairying, then will the dairy cow's entry into good society be made easy and her influence courted by the office seeker and her rights protected by the office holder.

I am impressed that some of the characteristics of the dairy cow are modesty, fidelity, patience, constancy and industry, and for these qualities she commands our admiration and is entitled to our most generous consideration. It is interesting to note her prominence in making history and the absence of any mention of her in recording that history. It is seldom she gets her picture on the front page of a newspaper. Mark Twain once said about the Platte river, that it was a mile wide and an inch deep—a stream of wide circulation and but little influence. While the dairy cow has been regarded as indispensable on every farm and her product a necessity in every family, my observation has been that as a rule she has had seemingly but little influence in the social, commercial and political field. The agricultural press devotes about half its space to corn and wheat, half of the remainder to cattle, horses, hogs and sheep and the rest to advertising, except one or two columns devoted to the performance of a record breaking cow or the failure of a scrub herd, that was half fed and had no care. Something over thirty years ago a dairy cow got some notoriety and her picture in the leading periodicals of the United States by kicking over a kerosene lamp and starting a fire that cleared off a patch of ground preparatory to the building of the greatest city of modern times, one that is commensurate with the demands of a great and growing country, thereby making herself a benefactor instead of the instigator of a calamity. It has not been long since she succeeded in getting her picture in one of the leading magazines because of a successful campaign conducted by her personally in favor of Peter Porter of Niagara Falls for Congress against the old time and popular politician, James Wadsworth.

When notice was served on me that I had been placed on the general evening program for on address on "The Dairy Cow" I appreciated that my audience would be composed of those whose interests were varied, and I appreciated keenly the responsibility of introducing and chaperoning this member of the world's animal aristocracy, and yet I say to you, in all seriousness, that it gives me great pleasure to present tonight the undisputed claim this noble animal has on each one of you. The dairy cow is akin to every phase of the commercial, industrial and social interests of this great State. Notwithstanding this, because of your varied interests and the different vocations of this assembly, I feel I would not have done my duty if I failed to acknowledge the gratitude, not only of Missouri dairymen, but of twenty millions of people who depend on her as a prominent source of revenue, for the recognition you have given her in this meeting, and if I succeed in presenting a single thought that will cause any one of you to hold the Missouri cow in higher esteem and that will cause you to surround her with environments that will extend her field of usefulness, I will have accomplished my most earnest desire, and the reward will be more than commensurate with the effort.

On the outside of the cover of the elaborate program provided for this week you have noticed the picture of a beautiful team of mules and under this picture is written: "Missouri stands at the head, the only safe place." I would that I might tonight paint another picture that you could take home with you and preserve on the tablet of memory. It would be the picture of a dairy cow, and underneath would be written: "Missouri stands at the other end, the only harbor of safety from financial panics and crop failures and industrial paralysis and commercial depression."

It would seem impertinent, almost, for me to attempt to give this intelligent and well informed audience the definition of a dairy cow, and yet, I apprehend, if each one of you were asked to give one, there would be a marked variance in the answers, for I am convinced that to an extent we each make our own dictionary. A man goes into a blacksmith shop, picks up a piece of iron and drops it without being told. The blacksmith asks him, "What's the matter?" And he says "It's hot." He says: "No, that isn't hot," and he picks it up and handles it without inconvenience or annoyance. Their definition of hot is not the same.

This same principle might be illustrated by a similar reference to everything, and among the many animals that are the subject of discussion at this convention, there is probably none that presents so many types in accordance with the different ideals as the cow. I admit that to the cattle man and to the casual observer the dairy cow is the least attractive, and yet to Mr. Reipbrock of Milwaukee, whose cow produced 1,000 pounds of butter in a year, a Guernsey cow is the most beautiful animal in the world. To the man in Holland, whose cow produced 1,100 pounds of butter in a year, and W. F. Gillette, whose Colantha produced nearly 1,200 pounds in a year, a Holstein is the ideal. Your Prof. Eckles and Mr. Austin, when thinking of a beautiful cow would see in their minds the picture of a Jersey. Dr. Niles of Lansing, Mich., would decide on an Ayrshire, and to these men these cows—that the beef man would make fun of, with long, thin necks, large paunches, large udders extending well forward, long, high rumps, dish face, broad loins, lean shoulders, deep chest, large girth, wedge shape and full, bright eyes, are the most beautiful specimens of the animal creation. It has been said of Bostonians that if every house in Boston was swept away by a cyclone and there was not a building left anywhere, to them Boston would still be there, and the reason given is that Boston is a state of mind. We are forced to believe that beauty is strictly a state of mind.

I can presume on the state of mind of many to whom I am talking and in consequence I will not attempt to introduce this noble animal (with all of her excellent traits of character and acknowledged usefulness) on the basis of beauty. While I will reserve the right to exhibit her in the sweepstakes ring, for the present I will enter her in a different class and in this class I am sure she will appeal to the beef man and the horse man and the hog man and the sheep man and the mule man and every man as being meritorious in the highest degree.

If you think the dairy cow homely, I ask you tonight to remember the most beautiful song that Missouri ever heard as she came at eventide from across the prairie and the winding paths of the forest along the banks of the historic creek, swinging her head with the proud air of a prima donna, and chanting in low, solemn tones an anthem of hope to Missouri mothers and Missouri children and keeping time to the music of silver dollars at the ratio of 16 to 1 as they dropped into the banks of Missouri to be drawn on as necessary to supply the wants of a people over whose destinies she seemed to have such wonderful control.

Is beauty the only standard by which you are governed in your consideration of friends? I answer, no. Do you know of anyone whom you regarded at first sight as being so homely your sympathies were aroused, and when you knew them better they seemed to get better looking until you couldn't detect anything homely about them? We have an old horse at our house, and if you will promise not to tell, I will confess to you that he hasn't a beauty spot on him, and yet when my wife takes the children and drives down the lake front she compares old Tom with every horse she meets, and her universal verdict is that for actual beauty Tom beats them all. I tell you beauty is a state of mind, and in any event there is something more substantial that appeals to our better natures. Usefulness is pre-eminent over all other attributes. Individuality is what we are impressed with.

Abraham Lincoln was a statesman, whose equal we have no knowledge of. He was a general such as the world never knew. The whole nation knew him to love him, and yet he could doubtless have emptied a house or dismissed an audience of his most loyal admirers in three minutes had he attempted to sing a solo. Henry Grady of Atlanta electrified and held spell-bound his hearers when he made that memorable speech at the banquet in Boston, the influence of which hastened the reuniting of a divided people and made us a unit with one government and one flag, and yet had he prepared with his own hands that banquet, I doubt not he would have been in no condition to talk, and the rest would have been too sick to hear. Jenny Lind electrified the people of two continents with her wonderful voice, and I would not forget that she got her inspiration from the vast audiences that greeted her everywhere and people who couldn't sing a bit.

Now, in discussing the claim of the dairy cow, let us decide whether she has any pull or not to make her welcome. Some of you may say, "Who is she?" "What claim has she on our time?" "What influence has she?" "What good can she do us?" Listen, are you a politician? She controls more votes than any other industry represented in this convention. Are you a banker? She deposited more money in the banks of our country last year than came from any other one source. Are you a merchant? She bought and paid cash for more merchandise last year than any other item of agriculture. Are you a stock raiser? She is stock. "She is the steer's mamma. She is the steer's sister. Her product is the foundation of a good hog." Are you a farmer? Exclusive of stock-raising as a specialty, she has made more good farms out of poor ones than all the other influences combined. She has changed more 6-bushel wheat land and 15-bushel corn land to 25 bushels of wheat and 75 bushels of corn to the acre than all of the combined effort of modern science.

It seems to me that above all professions the farmer has had the most pronounced recognition. Did you ever stop to think that the first farmer was Adam? Did you ever think that when God Almighty made this wonderful world, when He created this wonderful habitation of ours, when He had completed it and pronounced it perfect, when He had finished this universe with its majestic mountains, its extensive plains, its towering trees, its rippling brooks, its noisy rivers, its placid lakes, its rough oceans, its dense forests, its innocent flowers, this beautiful piece of architecture and workmanship, over which the inhabitants of the globe have gone into ecstacy for over 6,000 years and have continually found something new to admire, when, after this thousands of living creatures were created, when finally the climax was reached in the creation of man in God's own image, a perfect creature, that man was a farmer, and placed on a farm?

This is not all. Do you remember years after this, when God desired to recognize His children in a substantial manner for their obedience, or when He made them a promise of a rich reward for fidelity and compliance with His requests, in His desire to make this gift valuable, did He offer corner lots in some city, bank stock, mines of rich mineral, blocks of fine houses, droves of horses or beef cattle? No; He offered them farms. That was the most valuable heritage He could give them, and I want to call your attention further to the fact that He made this proposition just as attractive as possible by not only promising farms, but promising dairy farms—a land of milk and honey.

In conclusion, I would leave these thoughts with you tonight as reasons why the dairy cow should be most liberally introduced into Missouri, and at all times be the object of special care and consideration. She is entitled to this consideration because of her long years of usefulness. She is worthy of it because of her money-making power and by no means least in my estimation is her influence on the home. Prof. Oscar Erf of Ohio says he found in that portion of Europe where the most cows were milked. not only the best farms and the highest priced land, but he found a higher order of intelligence and more refinement. I believe that a man is made better for associating with a good dairy cow.

Ladies, if any of you have a man in your family who has an ugly disposition and hard to manage, I beseech you to get him into the dairy business as soon as possible. A cow is an advocate of temperance, she won't do business with a man who drinks to excess. If a man persists in swearing and talking loud, or gives way to his temper around where she is, she shuts off his supply. A moderate cussing and a lick with a milk stool will tie up her milk duct in a knot, and it's a case of visiting the iniquities of the father on the children, because they have to go hungry on account of their father's iniquitous conduct towards the cow. A man soon learns to quit hitting the cow or swearing at her because it costs too much. They soon begin to feel like Bob Evans did when one Sunday, in a strange city, he went to a very fashionable church and was shown a good seat that was unoccupied, and after a little while a very elegantly dressed couple came down the aisle and stopped at this seat and looked a little disgusted, but went in and sat down. The man evinced considerable annoyance, and finally handed a card to Col. Evans, on which he had written,"This seat costs me $25.00 a year. Col. Bob handed it back to him after writing on the other side, "It costs you too much." I commend this wonderful animal to you for her intrinsic worth. For thousands of years she has furnished a table delicacy that is not only desirable but a necessity.

As I leave this State and all of her interests, in the shadow of this great Agricultural College, I urge you tonight to accept the proposition made by the dairy cow. Install her in your cattle homes and she will improve your farms and enhance the value of your land; beautify your homes, build up your bank accounts; dispel every cloud of disappointment that comes from ignorance and superstition, and, as her home here at this College is a monument to the enterprising intelligence of our State Board of Agriculture and the wisdom of these grand men who are preparing your boys and your girls for their life work, let her home on each Missouri farm be a monument to the intelligence of Missouri people, and may each Missouri home indicate prosperity and happiness, all through the influence of the Missouri dairy cow.

ORGANIZATION AND CO-OPERATION.

(By Mr. A. J. McDowell, President Ozark Dairy Association, Fordland Missouri.)

This is an era of organization. We find organizations in every branch of business and every field of labor. Why, then, should not the farmers be organized? There are many farmers' organizations which have been and are doing much for the farmer, but in many cases they have been wrecked through lack of cohesion—the power to stick together.

Owing to the vast natural resources of our wonderful country, the American farmer has had a much simpler problem before him than has the European farmer. In fact, he has been able to prosper in spite of the many parasites which have been preying upon the agricultural body. But conditions have changed and the day has dawned when the American farmer must awaken to his condition and demand a fairer share of the products of his labor. These conditions have come slowly but steadily and with such stealth that the average farmer does not realize their presence, although he keenly feels their sting.

The most successful way to meet these new conditions is through organization, and one of the greatest lessons for the farmer to learn is to stick to his organization. If mistakes are made or abuses creep in, he must learn to correct them through the organization, not through the abandonment of it.

Perhaps the nearest to ideal organization among farmers is to be found in Denmark, where it is only through it that the Danish farmer can prosper. There is no trouble in holding their organizations together, as every Danish farmer seems to know that they furnish the only solution of their intricate problem of making profits from agriculture. All, or nearly all, of their products are marketed through co-operation and by that means sold direct to the consumer, thus the producer receives the highest possible price without increase of cost to the consumer.

I am told by a former banker of Jefferson county, Wisconsin, that thirty years ago 60 per cent of the farm lands in that county were under mortgage, and the average price of the land was $22 per acre. They took up dairying and formed various organizations to assist them, and now with only 35,000 inhabitants, they have over 40,000 dairy cows, the average price of farm land is more than $100 per acre, they operate 70 creameries, most of which are owned by the farmers, and the dairy farmers alone have more than $2,000,000 on deposit in the banks.

Such a showing taxes one's credulity and I feel safe in saying such results could not have been obtained except through co-operation. If Northern Wisconsin, with her cold, bleak winters, can accomplish so much in so short a time, what should Missouri, with her mild winters and wonderful advantages, be able to accomplish if thoroughly organized? If Missouri will proceed along the lines which Wisconsin has proved to be so successful her march to the front will be amazing in its rapidity.

While Missourians are noted for their pride in and love for their State, how much will this be augmented when Missouri has taken her place in the realm of states to which her natural advantages entitle her. And as there are several here from other states, I wish to serve notice upon them now that when Missouri is once thoroughly aroused, she will stand second to none. That whatever of excellence another state may attain along any line, Missouri has sleeping within her bosom the resources to duplicate or beat it.

But I have been asked to say something of the Ozark Dairy Association. It is an organization of about 300 dairy farmers who own 2,000 cows, and during the grass season sells about 30,000 pounds of butter fat per month. It was organized in May, 1908, for the purpose of selling cream to better advantage than its members as individuals had been able to do. Its first sale of cream was made on May 19th, and shipment made May 23rd. It is composed of nine stations, each having a local organization which has full control of all its local affairs, owns its own testing outfit, makes the tests upon which the sales are made and elects three members of the general organization.

The selling is done by a committee consisting of one member from each local station, which has full control of the sales, under the supervision of the general organization. This plan has proven to be simple, practical and satisfactory. Through it both price and tests have been advanced to such extent that the members have realized about six thousand dollars more for their cream during the last seven months of 1908 than they would have received had market conditions remained as they were at the birth of the organization.

Our association is satisfied, alert, active and aggressive and steadily growing, new members being added almost every week.

For several months prior to organizing, we sold our cream at 4½ to 7 cents below Elgin quotations. The organization sold at 3 cents below Elgin from May to October 1st; since at 2½ cents below. Our tests were formerly made by the use of the pipette. We now weigh the samples, which has caused our tests to advance three to seven points, according to the density of the cream. An average of about five points, but to be conservative, call it four points.

The average test at my own station is about 36 per cent. I presume the other stations run about the same. Hence, an advance of four points is an increase of about one-ninth in the amount of butter fat, which is an item worth looking after.

We expect to extend co-operation to other phases of the dairy industry in the near future. Some of the advantages which may be attained through organization are: The purchase of dairy feeds in car-load lots, thus reducing the cost to the minimum.

The purchase of the best breeding stock at small cost to the individual, so we may make more rapid progress in grading up our herds, and eventually create a market for all the good surplus we may produce.

Owning and operating our own creameries, as we believe the most successful dairying goes hand in hand with the local creameries.

And an awakening in the individual of a lively interest in and respect for his occupation, thus opening the door to better methods, more reading, more thought, more intelligence and a better citizenship.

With proper organization and a united effort, Missouri is destined soon to be one of the leading dairy states in the Union. It is within her reach, and her best interests demand that she should accomplish it.

It should bring the blush of shame to every Missourian's face to know that every year multiplied thousands of dollars leave our State to pay for the butter and cheese that we eat, while we should have an income of many millions annually for the dairy products which we can produce better than not. Let us rise to the situation and convert this tax, this drain upon our resources, into a source of revenue that will be an honor to our capabilities.

DISCUSSION.

Q. How do you support your organization?

A. Each local organization establishes a membership fee for the expenses of that organization, whatever it may deem proper. The general organization reserves a membership fee of $5 from each local organization, and then it has the power to levy assessments upon the local organizations to keep up expenses. The cream is all shipped through the committee, composed of one member from each local station, and any station that fails to ship its cream forfeits its membership and cannot be taken back into the association without the payment of a fee of $50 for reinstating and two-thirds vote of the association, so that when once out it rests with the association as to whether they are taken back. That applies only to the station. Each local station controls that matter with its membership along this line—that each member is under obligations to test his cream under the direction of the association, and if he fails to do so he forfeits his membership, and can only be reinstated by a vote of his local association and the payment of a reinstatement fee of $5, so that when once he fails to stand by his organization he steps down and out, and it rests with the organization whether he comes back. This reinstatement fee is required merely as a means of holding them together, because those of you who have had any experience in such matters know that there are always little troubles coming up, dissatisfactions, and if there were no penalty attached many of the farmers would throw the thing down and go his own way; then, when he saw his mistake, he would turn around and come back into the association; but where there is a penalty attached he will think twice before he throws the thing down.

Q. Is the cream sold on your test?

A. Yes, the test is made by the local station. Each local station owns its own testing outfit, and each station selects a man to do its testing. When we sell to the creamery we sell on the test made by those local testers, with the understanding that if they find any shortage they are at liberty to go to the stations at any time and have the matter corrected. Each individual's cream is tested separately, and he is paid for the butter-fat that is in his cream, and then the creamery makes a composite test of the whole shipment.

Q. Who pays the transportation?

A. The creamery. We are at no expense in shipping.

Q. In your opinion, what grade of dairy cattle is best adapted to the Ozark region?

A. I don't think it makes any particular difference, so long as they are adapted to our local conditions. I think that dairying there, as well as everywhere else, should be done with a dairy breed of cattle, and the particular breed should be a matter of individual taste. I think that a certain community should all breed the same breed of cattle until they get a sufficient number of that breed to create a market for that class of cattle, and it would result in benefit to the individual—by having a large number of one breed practically all together, so that a buyer could find in that locality what he wanted.

Mr. Hughes—I asked the question because we are thinking of buying some dairy cows.

A. I would not hesitate to bring any breed into your region, the conditions are favorable to all of them, but for dairy purposes I believe in dairy cows. If I were a rural mail carrier I would not want a 1,600 pound Percheron horse to carry the mail; and in dairying I would not want a 1,500 pound beef cow to dairy with. I believe that a dairy cow should be used because she has been bred for that purpose, and we must either recognize the fact that the dairy cow is better for dairy purposes than the beef animal, or else we must acknowledge that there is absolutely nothing in breed. If nothing had been accomplished in all these years in breeding dairy cows, then we would need to quit breeding them; but things have been accomplished in that line the same as in other lines.

Q. Some people think that the largest cows are best for dairying. Did you not say that you were opposed to size, if other conditions were right?

A. I don't care whether she is large or small, just so she measures up to the Babcock test. As a general proposition, no matter what breed you have, you will find that 50 per cent of the cows that are best are those of a medium to slightly large build. A small cow is not apt to be as good at the pail as one that is medium size.

TREATMENT FOR CONTAGIOUS ABORTION.

Barn Wash—

Corrosive sublimate, 1 oz.; water, 8 gallons; or
Bluestone, 1 oz.; water, 4 gallons.

Directions—

After thoroughly cleaning out and burning all infectious material, thoroughly sprinkle the drain, the floor and the stalls with this solution. Repeat this often.

Wash for the Cows—

Permanganate of potash, level teaspoonful; water, 3 gallons.

Directions—

Clip the hair on the tail and about the genital organs of any cow that has aborted and is filthy. Thoroughly wash off these parts with the permanganate solution until clean. Insert one end of a rubber hose into the womb and hold the other end up some distance. Insert a funnel into the outer end of the hose and pour the wash into the funnel. When the womb is filled up with the wash, lower the funnel down towards the ground and syphon the solution out. This solution should be used at body temperature or a little above, and never cold. Wash each filthy animal every two or three days until clean. Clip the hair from over the sheath of the herd bull and keep the sheath well washed with the solution. There is no danger of using too much of this solution.

Carbolic Acid Solution for Hypodermic Injection—

Pure crystals of carbolic acid, 2½ ozs.; water, 1 gallon.

Directions—

Boil the water, cool it, add the carbolic acid and keep the solution in a sterilized jar or jug. Treat the bull and all the cows with this solution by injecting it under the skin with a hypodermic syringe. It is best to prepare a chute in which each animal may be securely held for the washing or for this injection. Use a 2-dram hypodermic syringe. Give each animal 6 syringefuls at one treatment. It is best to inject each syringeful at a different place on the body, a few inches, at least, apart. Repeat this every ten days until six treatments are given. After the second treatment, increase the number of syringefuls to the limit the cow will stand. Give one or two extra syringefuls and wait a few minutes and watch the cow's eyes. A dilatation of the pupil indicates that enough has been given. When a little too much has been given the cow may stagger somewhat on leaving the chute. These symptoms will soon pass off. Give the cow as much as she will stand without causing her to stagger.

This course of treatment should result in ridding any herd of contagious abortion in 60 days. It will prevent the pregnant animals from aborting and will prepare those that have aborted for successful breeding.

N. B. In case any cow begins to show the signs of calving before time, the carbolic acid injection should be given every other day to check up the threatened abortion. In extreme cases, where labor pains have set in, the abortion can often be checked by using a mixture of 2 parts Fluid Extract Black Haw and 1 part laudanum. Give 3 ozs. at a dose, and repeat in 3 hours, if necessary.

D. F. LUCKEY,
State Veterinarian.

RESOLUTIONS ADOPTED BY THE MISSOURI STATE DAIRY ASSOCIATION AT ITS 19TH ANNUAL CONVENTION, COLUMBIA, MO., JANUARY 7-8, 1909.

1. Resolved, That the Dairy Association recommend such action by the Legislature as will encourage desirable immigration into the State and advertise the dairy resources.

2. Whereas, The secretaryship entails considerable work; therefore, be it

Resolved, That the President, Vice-President and Treasurer of this Association form a committee to compensate the Secretary for his services commensurate with the financial condition of the Association.

3. Whereas, It is important that the Dairy Department of the Agricultural College be brought into closer touch with the dairy farmers of the State; be it

Resolved, That the State Legislature, now assembled, appropriate sufficient funds to carry on work among them under the direction of the Professor of Dairy Husbandry.

4. Realizing that the crying need of the hour with Missouri dairymen is the dissemination of dairy knowledge; therefore, be it

Resolved, That it is the sense of this Association that the State Board of Agriculture should provide dairy speakers at all Farmers' Institutes held in localities where there now is, or soon may be developed, any reasonable amount of dairy interest.

5. Resolved, That the Association should stand by Dr. D.

F. Luckey in the enactment of laws for the control and suppression of that most dread disease to dairymen—tuberculosis.

6. Resolved, That the Dairy Association recommend and urge that section 10548 and 10549, Revised Statutes, 1889, be amended by the 45th General Assembly, by inserting the words "tuberculosis" and "foot and mouth disease" therein, and that a new section be added, providing for the shipment, for immediate slaughter of cattle condemned on account of tuberculosis, to a slaughtering plant having Government or State meat inspection and a rendering tank into which the diseased parts may be safely deposited.

7. Resolved, That the Association recommend that the office of State Dairy and Food Commissioner be appointed by and placed under the control of the State Board of Agriculture, thereby making it non-political; the incumbent being selected for his competency and his peculiar fitness for this very important position.

8. This Association is indebted to the State Board of Agriculture and its able Secretary, Geo. B. Ellis, for his help and continuous support in our behalf, and,

Whereas, We have lost during the past year, Mr. Washburn, our able and efficient Secretary, the Association owes him its gratitude. And this Association is indebted to the University for the courtesies extended at all times, and especially for the privilege of the use of its halls for our annual meeting and for the bounteous banquet served to all farmers during Farmers' Week.

9. Resolved, That the Association, through its executive committee, take some definite action to co-operate with the State Fair Board and the Dairy Department of the Agricultural College to provide for a great dairy show at the State Fair, including cattle and dairy products.

10. We realize that the expense of attending the annual meetings of the Association is the cause of keeping many, in remote parts of the State, from being present, and, realizing the need of reaching these people with the good things we enjoy here, we resolve that there be formed four district dairy associations, one for each quarter of the State, said associations to be under the guidance of the State Association, and to receive such aid on the program from our State instructors as is possible for them to give, believing in this way we can reach a large majority of our dairy farmers who have not attended our State Association Convention. We recommend that one man be appointed in each district to perfect each organization.

Swine Growers' Session.

January 6, 1909.

THE CONTROL OF HOG CHOLERA.*

(By J. W. Connaway, Professor of Comparative Medicine and Veterinarian of the Missouri Agriculture Station, College of Agriculture, University of Missouri.)

Mr. President and Gentlemen of the Swine Growers' and Breeders' Association:

At the meeting of this Association held a year ago I gave a brief history of the researches on hog cholera that had been made in this country by a number of investigators; some connected with the National Department of Agriculture, others working in the State departments. Particular attention was directed to the more recent and very important work of Dr. Dorset and associates of the U. S. Bureau of Animal Industry on the etiology (cause) of hog cholera; and to their subsequent work on immunity against that disease—researches which I am confident furnish a sound basis for the practical solution of the *control* of hog cholera. I also reported in some detail the experiments which we have carried out at the Missouri Experiment Station in co-operation with the U. S. Bureau in testing the immunizing value of the blood serum of swine made "hyperimmune" to hog cholera. As this was published in the last annual report of the State Board of Agriculture, and in an Experiment Station pamphlet (circular No. 29), as well as by a few of the leading live-stock and farm journals, from which extracts have been widely copied by the popular press, it will not be necessary to give the details of that work at the present time.

The result of these experiments and the wide-spread interest which has been aroused among the breeders, swine growers, and feeders not only of Missouri but of a large number of other states, has brought to us an overwhelming number of inquiries for further information, and requests for the "immunizing serum." I have thus been very forcibly impressed with the fact that hog cholera is indeed a live question. It is probable therefore that nothing which I can present to you today will be more acceptable than a talk on the practical phases of the control of this disease, and particularly the part which "preventive inoculation" is to take in that work.

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*Revised to include data up to time of publication.

The experiments mentioned encouraged us to give a more extensive trial to this method, with the view of testing its practicability when applied under the varied conditions that exist on the stock farms of the State. Also to attempt to improve upon the methods of producing the "immunizing serum," with the view of increasing the quantity and lessening the cost.

This larger test, which has been carried on during the past year, has included over six thousand hogs, in thirty counties of the State. The results justify us in the opinion that preventive inoculation by means of this "immunizing serum" is destined to play an important role in the eradication of hog cholera. I shall return to this part of the subject after considering other phases of the question, which more appropriately stand first.

For effective work in the control and final eradication of hog cholera, "preventive inoculation" must be supplemented by other measures—which are of easy application by the farmers themselves, and by means of which (even without inoculation) outbreaks have time and again been kept within narrow limits and great losses doubtless averted. In the past the neglect of many swine raisers to apply even simple preventive measures has been mainly due to a lack on their part of reliable information in regard to the nature of hog cholera—its diagnosis, the manner of its spread, and the means by which it may be held in check—I am sure that I can render no better service to those present than to dispel some of the erroneous notions that prevail in regard to this disease, and to give whatever is of practical importance for you to know in regard to cholera and its control. I shall attempt to give this information in plain, untechnical terms which every one can understand, for in my opinion the control of cholera depends quite as much on the active interest, and intelligent cooperation of the farmers, swine breeders, feeders, shippers and managers of live stock exhibits in efforts to eradicate this disease, as it does upon the Veterinary Service of Boards of Agriculture, or Experiment Stations.

DIAGNOSIS OF HOG CHOLERA.

In the control of any contagious or infectious disease the *early* recognition of its presence is of prime importance, in order that prompt action may be taken before it has gained great headway. This is particularly true of hog cholera, which is one of the most infectious of the animal maladies. The common impression among farmers and many veterinarians is that hog cholera presents a definite, unvarying train of symptoms, and that the "post-mortem" appearances in one case give a fair picture of what may be seen in all other cases of this disease; but the fact is that scarcely any other disease shows such a variety of symptoms, and disease changes in the internal organs, as is shown by cholera, including its complications.

Types of Cholera—There are two general types of the disease, *acute* and *chronic.* In the acute form a number of animals of a herd may die suddenly or after a very short illness; while in the chronic type the animals often live for several weeks, become very thin in flesh and die, one or two at a time. The cause of the disease is the same in both types; the only difference being in the degree of virulence of the infection, or the difference in the resistance of individual animals, or herds. In many outbreaks, and especially in the slow lingering type, the disease first appears among the pigs and shoats. The very acute type often appears first in the heavy, fattening hogs.

Symptoms—The following *symptoms* will be observed in nearly every outbreak of cholera, but not in every individual hog affected with the disease. Animals that succumb to the acute form of the disease show but few symptoms before death. They may eat well at night and be found dead the following morning. In other cases they may have a profuse diarrhoea, greenish, black or bloody in character; vomiting may occur, and bleeding from the nose, a reddening of the skin of the belly and legs may be seen. All these external signs may however, be lacking in individual cases, but a "post-mortem" examination of such cases will as a rule show plain evidences of cholera. In the more chronic type of the disease the sick hogs cease to eat heartily, are sluggish, show an inclination to burrow into the bedding and shiver as if cold, even in pleasant weather. After a few days the hair becomes rough, the skin becomes scaly or may show a reddening, either diffuse or in spots on the under surface of the belly. In prolonged cases of the disease ulcers may appear on the skin, especially about the joints. The tips of the ears in some cases slough off. The eyes become watery or show a "mattery" collection at the inner corner of the eye. The eyelids in some cases are glued together. Animals suffering from the chronic form fall off greatly in flesh, they become weak, especially in the hind quarters, and have an unsteady wabbling gait. Some of the sick animals develop a cough, and may show increased respirations; some affected in this manner bleed at the nose, some vomit, some have a profuse watery diarrhoea, the discharges in some cases being of a yellowish or ochre color, resembling the typhoid stools of man; in other cases the discharges are greenish or black in color, and at times quite bloody. Contrary to common opinion, many hogs affected with cholera suffer from constipation; and at death the large intestines may be found packed with hard lumps of almost dry dung. Hogs suffering from cholera have an inclination to eat dirt and gravel, and in some cases the stomach and intestines contain a large quantity of this material. "Thumps" is a sympton often seen in cases of cholera. The temperature runs high—104 to 107 degrees. The younger animals of a herd often contract the disease first and appear to be less resistant than adult hogs. This may be due to the fact that the pigs are more difficult to keep in an inclosure and consequently range more widely than the larger hogs and are more liable to come in contact with the infection from neighboring farms, and ingest a proportionately larger amount of infection than the larger hogs.

IMPORTANCE OF POST-MORTEM EXAMINATIONS.

Since some of the symptoms which have been given are common to other ailments, it is important to not rely wholly on these symptoms for a diagnosis. I cannot impress too strongly the importance of farmers and veterinarians making a post-mortem examination of the hogs that die; since an accurate diagnosis of cholera can by this means be more readily made; and the sooner it is made the better.

Too many farmers are inclined to think that because they have not had a medical training it would be useless for them to make the examinations suggested. In this they are mistaken, for some of the best descriptions of diseased conditions I have read were written by farmers who described in plain English the appearance of the diseased organs as they saw them. They did not know the meaning of the changes described, but it was easy for me to make a diagnosis from their accurate descriptions. Every farmer knows the common name and the natural appearance of the internal organs of the hog, and they should make themselves familiar with the changes that occur in cholera, since expert veterinary aid may not be available at the time when most needed. If uncertain as to the nature of the disease, they can refer their descriptions to an expert for interpretation. If the diagnosis is made on the first few pigs that become sick, much time will be saved in combating the infection.

I shall now attempt to describe as clearly, and as simply as possible the method of examining the carcass of a hog, and the appearances of the organs that show disease changes due to cholera.

It is essential to examine the carcass soon after the death of the animal, in order to avoid being misled by the ordinary decomposition changes that occur in the internal organs within a few hours after death.

First, examine the skin; observe whether there are any eruptions, ulcers, patches of redness on the skin of the belly ("bloodshot" spots or patches showing through the skin). The presence of these signs with the symptoms already given are indications of cholera. The animal may, however, have cholera without showing any eruptions or other noticeable changes in the skin.

Make a cut from the point of the chin backward along the midline of the neck, chest and belly to the tail, cutting first only through the skin and underlying fat. Peel the skin and fat well back on each side, examine the fat beneath the skin for hemorrhages, or "blood shot" discolorations. In the acute hemorrhagic type of the disease the subcutaneous fat is often the seat of numerous hemorrhages. In the fat of the flank region the hemorrhage is sometimes extensive. Mild cases of cholera show no disease changes in the subcutaneous fat. At the angle of the lower jaw beneath the skin will be found rounded glands, called lymph glands, which in the acute hemorrhagic type of cholera are often engorged with blood, giving to them a reddish, or even black color. In mild or chronic cases of cholera these glands may be enlarged, dropsical and of a normal grayish color. A few inches back of the glands mentioned other glands are located which may be highly engorged

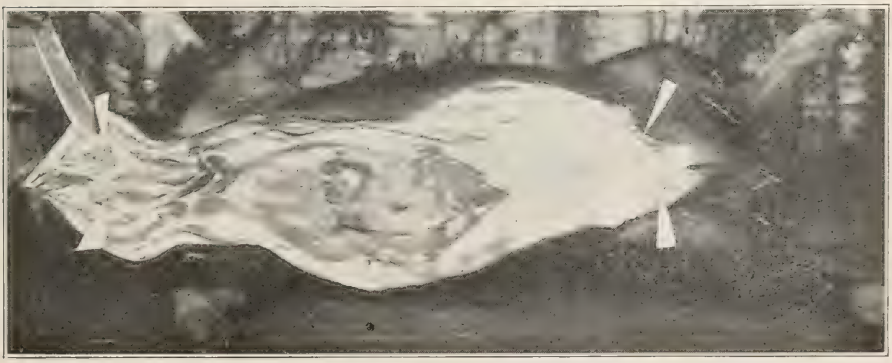


Fig. 1. *Post-mortem Examination.* First incision, showing engorged lymph glands (cervical and inguinal), and numerous hemorrhages into the subcutaneous fat, in the acute hemorrhagic type of cholera.

Veterinary Department, Missouri Experiment Station.

with blood. Tolerably large lymph glands are also to be found in the flank; observe whether these are engorged with blood and of a color varying from red to black. In some cases but little change occurs in these superficial lymph glands.

Next cut into the abdomen and expose the stomach, liver, intestines, etc. Before displacing any of the organs observe whether there are any hemorrhages on the inner surface of the walls of the abdomen; note whether the intestines, large or small, show any spots of hemorrhages. In the acute type of cholera it is not uncommon to find portions of the small intestines thickly covered with small points of hemorrhage; and more frequently quite large "blood-shot" spots on the large intestines, and in the fatty membrane which binds together the intestinal coils. The outer coat of the stomach, in some cases, is also the seat of hemorrhages. The spleen may be enlarged and softened, or may be about normal size and show small blood spots on the surface, especially on the under surface.

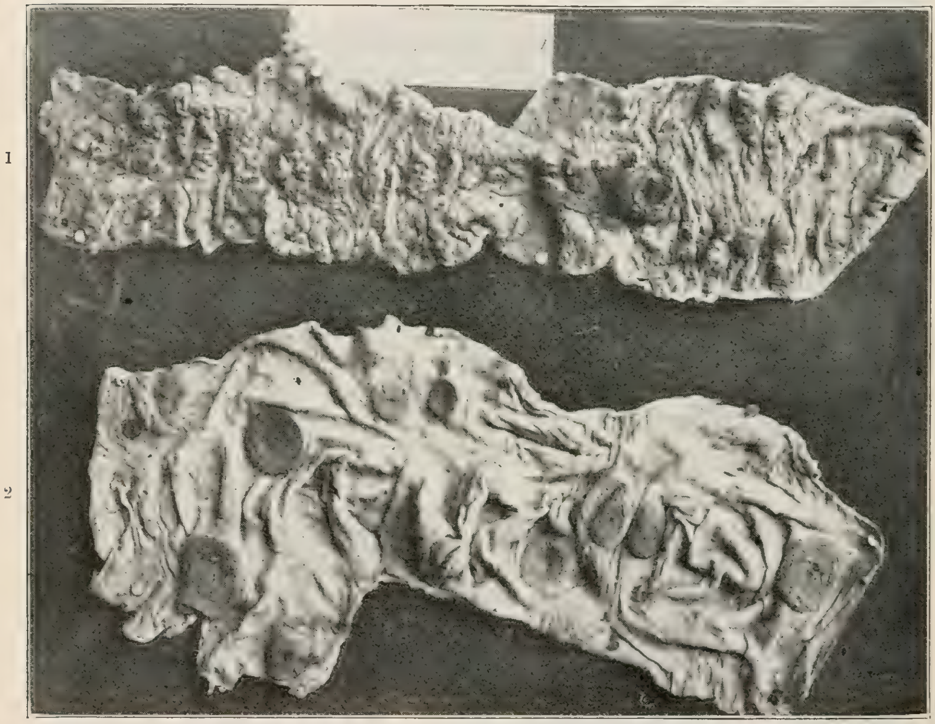


Fig. 2. Ulcerations of large intestines.
(1) Shows diffuse inflammation.
(2) "Button" ulcers in blind gut.
Veterinary Department, Missouri Experiment Station.

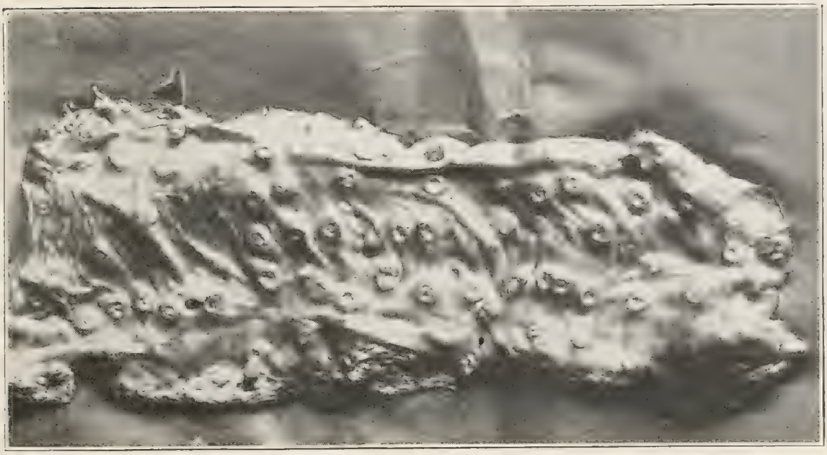


Fig. 3. Ulcerated small intestine, sometimes seen in hog cholera.
Veterinary Department, Missouri Experiment Station.

The changes that occur in the *liver* are not such as would attract the attention of the average observer.

The *kidneys* in very acute cases frequently have numerous small blood points scattered over the surface, giving to the organ a speckled, "turkey egg" appearance. These small hemorrhages are more numerous on the lower surface. On cutting into the cavity of such kidneys, blood clots are often found. In mild or chronic cases the kidneys appear normal. The *bladder* may also be the seat of extensive hemorrhage, especially on the mucous surface.

In some animals which have died in the same herd, as those showing the hemorrhagic conditions mentioned, the outer surface of all organs examined may appear quite normal, and no suspicion of cholera would be aroused; but on examination of the mucous surface of the stomach and intestines positive signs of cholera are often found.

Remove the stomach and intestines and make an examination of the inner walls. This is best done by stripping away the fat which holds the coils of intestines together, then with a knife or a pair of scissors cut open lengthwise portions of the large intestine, beginning with the blind gut and continuing some distance along the large intestine. Wash away the dung carefully, without scraping the surface of the gut. The mucous surface of these parts in some animals that die of cholera appear to be in a healthy condition; in other cases, however, there will be seen, scattered here and there rounded ulcers varying in size from a fourth to three-fourths of an inch in diameter. The wall of the intestine at this point is thickened and the surface of the ulcer is elevated slightly above the mucous surface of the gut, and resembles a flat circular button, hence the term "button ulcer," which is applied to these ulcers. The presence of these ulcers can often be detected before cutting into the gut by the presence of a circular inflamed area on the outer surface. The thickened margins of the ulcer can be felt through the walls of the gut. In other cases there is a thick, yellowish, tough, cheesy-like exudate (diptheritic membrane) covering the wall of the large intestine over considerable extent, and very firmly adherent. This is the result of a diffuse inflammation of the mucous and submucous membranes. The walls of the intestines in such cases feel thick and leathery. In the acute hemorrhagic type of the disease, extensive hemorrhages into the large and small intestines sometimes occur. So that on opening the gut, clots of blood, almost filling the cavity, are found.

On opening the stomach the mucous membrane in many cases, appears normal, in other cases it appears greatly inflamed, and sometimes blood clots are found.

Next examine the *organs of the chest cavity.* This cavity can be opened best by removing the breast bone. Cut through the cartilages where the ribs join the breast-bone, press apart the ribs and note the condition of the lungs. In health they have a light

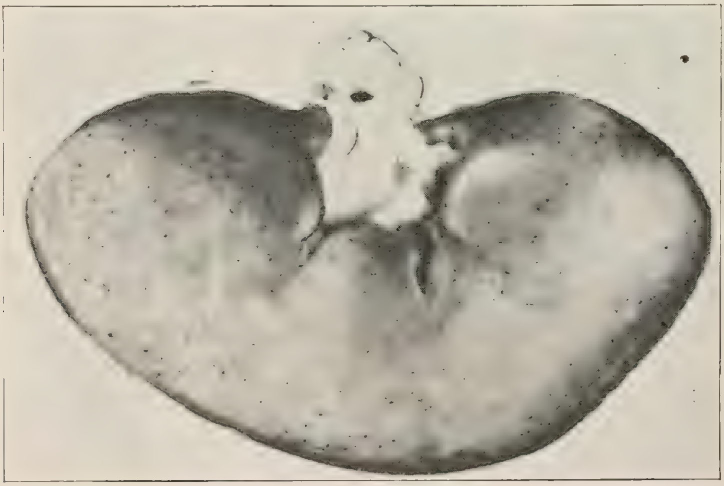


Fig. 4. "Speckled" kidney, often seen in the acute hemorrhagic type of hog cholera; due to minute hemorrhages.

pink color and collapse when the chest cavity is opened, and are soft and pliable to the touch. In many cases of cholera the lungs have a normal appearance. In other cases the lungs present a wide range of disease changes, varying from a few minute hemorrhages, on one or two lobes, to an almost complete solidification of both lungs. Frequently there is an extensive, straw-colored, coagulated exudate covering one or both lungs. This coagulum causes a slight adhesion of the lungs to the ribs; this adhesion is, however, easily broken down by the fingers. In prolonged chronic cases of cholera, white fibrous bands "pleuritic adhesions" are sometimes found binding the lungs very firmly to the ribs. These lung complications are often mistaken by farmers and by veterinarians for an ordinary pneumonia or pleurisy, and have also been called "swine plague."

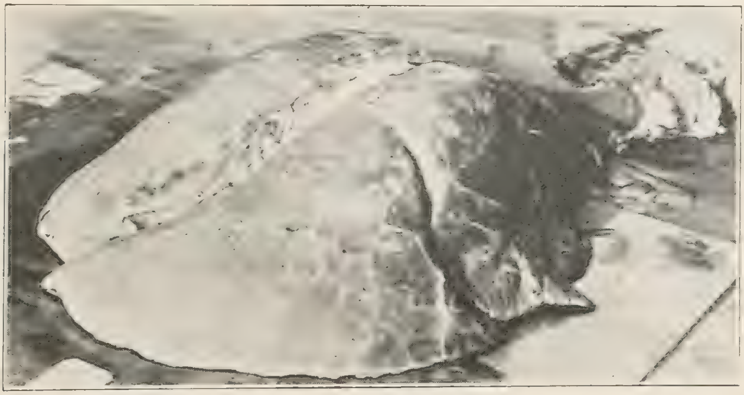


Fig. 5. *Diseased lung in hog cholera.* The so-called "swine plague" form. The darkened areas show the parts most frequently affected. They become solid and liver-like.

Veterinary Department, Missouri Experiment Station.

The *heart,* in many cases, shows no signs of the disease. In others the walls are the seat of numerous spots of hemorrhage. These occur more often on the outer wall than on the inner surface, and at the base of the heart, on the auricles, rather than on the ventricles.

In an outbreak of cholera, nearly all the diseased conditions mentioned have sometimes been found in the first one or two animals examined, and a positive diagnosis is quickly established. On the other hand, the first animal examined may reveal but little that is regarded as typical of the disease, and a failure to diagnose the trouble may result if another hog or two are not examined. It should be remembered that cholera is primarily a blood infection, and death may occur without any marked visible changes in the various organs of some of the affected animals. The presence of intestinal worms in a case of this kind has more than once misled farmers and veterinarians to an incorrect diagnosis.

The opinion has prevailed for many years that two wide-spread infectious diseases exist among the swine of the country. One called "hog cholera," affecting principally the intestinal tract, showing typhoid symptoms, and ulcerations; the other called "swine plague," and marked by a more or less extensive congestion or inflammation of the lungs. While it has not yet been definitely proven, the indications are strong that we have but one disease; and that the differences which have led to the two names are simply complications of the one infectious malady. In a somewhat large experience I have always found both the intestinal and the lung complications in different animals of the same herd, and often in one and the same animal. In experimental cases, hogs that have been immunized against "cholera" by the new "hog-cholera-serum" do not contract "swine-plague" when exposed to hogs suffering from that type of the disease. Moreover, the inoculation of healthy pigs with infectious blood from an animal suffering from one type, may produce the other type of the disease. I am confident, therefore, that for all practical purposes it will be wise to quit using the term "swine plague," and apply the popular name "hog cholera" to *every* outbreak of an infectious swine disease, in which large numbers of hogs die; for it is probable that the true infectious agent in every outbreak of an infectious swine disease in this country is the "filterable virus" of hog cholera, the existence of which was demonstrated by Dr. Dorset and associates. It is, however, probably true that the ulcerations of the intestines, and their typhoid condition is partly due to the *associated* action of the ordinary colon bacillus, or to the bacillus described by Salmon and Smith as the hog cholera organism; and, that the "pneumonic complications" are partly due to the associated action of what has been called the "swine plague bacillus." With the evidence available, we must, however, regard these associated bacteria as harmless under ordinary conditions. They probably invade the tissues of the body only after the "true virus" of cholera has prepared the way.

What has been said is probably sufficient to enable you to recognize the presence of cholera in your herds.

HOW THE INFECTION IS PROPAGATED AND SPREAD.

A knowledge of the ways in which the infection is propagated and spread is essential to the application of rational methods of control of hog cholera. Every infectious disease is due to a specific cause, in the nature of a parasitic micro-organism, which lives and multiplies for a time in the body of the hog that suffers from a disease. In hog cholera the exact nature of this germ has not been determined. These facts, however, have been established: The micro-organism exists in a virulent form in the blood, and organs of the body, and in the excretions of the sick animal. This has been proven by feeding and inoculation experiments on susceptible hogs. The urine and dung of the sick animals retain their virulence for a considerable time after passing from the animal; as shown by the fact that susceptible animals, when put in pens previously occupied by sick hogs, contract the disease. The dung and urine of sick hogs, and the carcasses of hogs that have died of cholera, are the usual sources of infection from which fresh outbreaks of cholera originate. There are a variety of ways in which the disease is carried from a focus of infection. The pigs from a healthy herd often become infected from a diseased herd of an adjoining farm by breaking through insecure division fences and carry the disease to the home herd. A sufficient amount of infectious dung may be carried on the shoes of a person, who has walked about in a pen containing diseased hogs, to start the disease in a healthy herd. Dogs may also carry the infection from one farm to another on the feet, or by carrying home a portion of a diseased carcass, which had not been properly disposed of. Barnyard fowls often spread the disease quickly over the farm from the first infected pen. Pigeons and crows, after feeding among diseased hogs, may carry the infection to the feeding lots of a neighboring farm. The litter and dung from infected pens, or portions of a decaying carcass, may be carried a long distance by the natural streams, or by drainage following heavy rains. During outbreaks of cholera, it is the custom of farmers to put on the market the healthy looking hogs from a diseased herd. Some of these apparently healthy hogs are, in fact, infected with the disease; and all of them carry at least a small amount of infectious material on their feet and bodies. If such animals are *driven* to the shipping station, as often happens, some disease producing material is dropped on the public highways to be picked up by the pigs of abutting farms. The small streams that run across the roads over which infected animals are driven are also contaminated and carry infection to adjacent farms. The small and large stock yards are distributing points of cholera infection. Many a farmer, who has delivered a load of healthy fat hogs to the stock yards at his shipping station, has carried home on his shoes sufficient infectious material to start an outbreak of cholera among the hogs that were kept for breeding purposes.

The swine quarters at "stock shows," state and county fairs, have at times become infected with cholera through the carelessness or ignorance of an inexperienced exhibitor or herdsman in exposing his show herd, in the stock yards at his home station, when starting on the show circuit, or shipping the animals in an unclean, infected hog car. During the past year cholera was brought to the State Fair and the "American Royal" by a herd from an adjoining State, and was followed by outbreaks in eighteen (and probably more) registered herds, and was carried to four different states. One exhibitor says that he lost ten thousand dollars' worth of hogs. Some of the best show animals, and a large number of his herd died. The losses by a number of other exhibitors were very heavy. In this case every precaution had been taken by the State Fair management to provide clean, disinfected quarters. This work, however, went for naught because of the inexperience of one herdsman who had charge of a valuable herd.

MEASURES OF PREVENTION AND CONTROL.

What has been said about the nature of the disease, the symptoms, post-mortem appearances, the sources of infection and the various ways in which it is spread, suggests many practical methods of keeping the disease out of a herd; and of limiting its spread should it by any means be brought into a neighborhood.

In the purchase of breeding hogs it is a wise precaution to ascertain whether the farm from which the purchase is made has had any recent cholera infection. The hogs purchased should be kept apart from the home herd for a few weeks in well isolated quarantine pens. The animals should be dipped or sprayed with some disinfectant. They should also be given several days' treatment with an intestinal disinfectant, in order to clean the digestive tract of any cholera germs that may be lying dormant. For this purpose I would recommend giving with the food the mixture commonly known as the "Government Hog Cholera Remedy" (see Farmers' Bulletin, No. 24, U. S. Department of Agriculture) which is a good laxative and intestinal disinfectant. In cases where the purchased animals have been exposed to the cholera, a quarantine of 40 to 60 days is advisable before placing them with the home herd. The quarantine pens should be thoroughly disinfected at frequent intervals by spraying well with a 5% carbolic acid solution, and sprinkling liberally with air slacked lime.

When it is necessary for a farmer to go into the stock yards or to an infected farm, he should disinfect his shoes by wiping them off thoroughly on a grain bag which has been saturated with a 5% carbolic or creolin solution, or a strong hog dip. This requires but a moment, and is a precaution which is well worth taking. Discourage the visits of crows and pigeons to your feeding pens by appropriate measures. Look well to the condition of your fences to prevent the smaller pigs from invading the hog yards of neighboring farms. Locate the hog pastures so that they will not be regular passways for visitors and farm hands, who may bring infection on their shoes. Do not drive your hogs to market, and discourage others from doing so. Haul them in a close bottom hog crate, and sprinkle the floor of same with air slacked lime, or disinfect it with a 5% solution of carbolic acid at the stock yards before returning home.

Neighbors should report the disease to one another as soon as possible after an outbreak, in order that proper precautions may be taken by every farmer in the neighborhood to avoid the further spread of the disease. There is a law requiring such notification, which every one should follow without compulsion.

It should become the practice of hog raisers and feeders to remove at once from the herd every hog that becomes sick, and put same in a small quarantine pen, which can be easily disinfected, and from which the barn-yard fowls should be kept by means of wire netting. One sick animal, if kept a few days in the herd, will scatter the virus widely over the feeding yards and lead to the infection of a large number of animals. When assured of the presence of the disease in the herd, if it is feasible, divide the herd into several small lots and put them on clean grounds. If this cannot be done, scrape the litter from the old yards and mix it well with lime. Then scatter quick-lime freely over the hog yard. During an outbreak of hog cholera, shut the chickens away from the hog lots to prevent them from scattering the infection from pen to pen. A few yards of chicken wire is an important aid in controlling hog cholera.

An attendant who has charge of sick hogs should not, if possible to avoid it, go about the pens containing the healthy hogs, but when this is unavoidable, he should disinfect his shoes thoroughly before going among healthy hogs.

The carcasses of all pigs that die on a farm should be burned. If this is impossible on account of scarcity of fuel, they should be buried deeply, putting in sufficient quick-lime to destroy the infection. The practice of some farmers of piling the dead hogs in a ditch, at the back of the farm, to decay and become a source of infection to all parts of their own farms, and a menace to the herds of their neighbors, cannot be too strongly condemned. There is a State law against such practice.

More rigid measures should be enforced to prevent the introduction of infection into the valuable "show herds" exhibited at State and county fairs. The officials of the fairs should insist that exhibitors shall not take to the fair animals that have been exposed to the cholera within sixty or ninety days, and that the animals shall be disinfected at the farm before shipment, and transported to the fair in a manner to avoid all possibility of becoming infected en route; that is, the shipping crates should be new or thoroughly disinfected, the wagon box in which the animals are hauled to the shipping station should be well cleaned and disinfected (with a 5% solution of carbolic acid,) the crated animals should be put directly from the farm wagon into a car in which they are to be shipped, and should not be permitted to come near the local stock yards at the shipping station. If the animals are to be shipped by freight a car should be selected that has never been used for shipping market hogs; a grain or general merchandise car should be used. The disinfection of the wagons or drays used to transfer the hogs from the car to swine quarters at the State Fair should not be neglected. If *every exhibitor* will take due heed to the precautions which have been given so as to avoid exposure of his "show herd" to any source of infection from the time of starting on the show circuit to his return home, the severe losses that many exhibitors have sustained in the past, will not be repeated, and the State and county fairs and other stock shows will cease to be distributing points for this disease. Proper measures should, of course, be taken, and probably are taken, by officials of every State fair to thoroughly disinfect the quarters which are to be occupied by the show herds entered for exhibit, and have such quarters so arranged that they may easily be kept in a sanitary condition. During the progress of the fair a close watch should be kept on all the lots of hogs for the appearance of any illness, and all affected animals should be promptly removed for further observation and treatment to an isolated hospital section in charge of the official veterinarian of the fair. Such hospital section should be so arranged as to shut it off from access to all except the officials, and the owner of the sick animals.

STOCK YARDS SANITATION.

We should confidently expect that at no very distant time, the large and small stock yards will be kept free from cholera infection, so that stock hogs may be purchased at said yards at any season, for stocking up the farms, which have an abundance of feed, but are short on hogs. At present, the great stock yards are considered to be permanently infected with cholera, and hogs that enter are not permitted to be shipped out, but are sold for immediate slaughter, no matter how unfit they are in weight and condition, for packing purposes.

Stock hogs can, however, be purchased in the interior of the State, and collected in the local stock yards of the towns and villages, and shipped to distant parts of the State. These small yards are scarcely less dangerous than the large stock yards of the great packing centers; and some of them are, no doubt, more dangerous, as they have dirt floors and have been collecting cholera infection for many years. In many of these yards no attempt at disinfection has ever been made. Such yards are a menace to a farming community, as points for distributing cholera infection. The cost of paving these small yards with non-porous brick or rough concrete, and providing hydrants and hose so that they can be kept in a clean, sanitary condition, would not be excessive. The saving to the farmers in a season or two would more than pay the cost. It would improve the business of these yards, and the railroads to maintain sanitary stock yards in the small towns, especially in sections where many hogs are sold as "stockers," to be shipped to other sections where corn is the principal crop, and where numbers of hogs must be bought for feeding.

The local trade among farmers would also be stimulated, since there is a real need of clean, sanitary stock yards where farmers can bring their surplus stock hogs, that are unfit for shipment to the large markets, but are needed by other farmers of that community who would readily buy, if it were safe to take pigs to their farms from the stock yards.

The maintenance of clean stock yards would lessen to a considerable extent the need of the thorough disinfection of the stock cars.

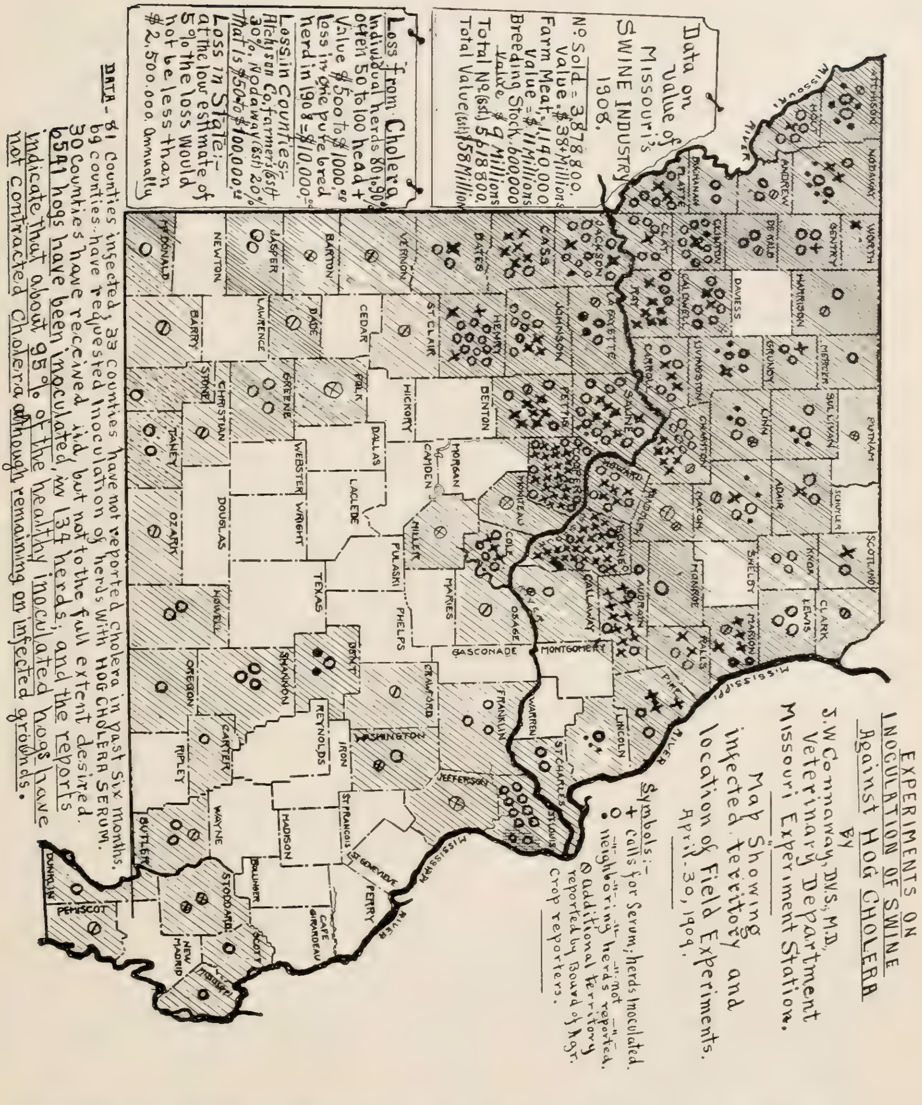
The cars in which swine are shipped should, under present conditions, be thoroughly cleaned and disinfected before they are returned to the country districts—they are otherwise a means of spreading the infection, through the litter that falls from the cars en route, or is thrown out at the end station.

The tagging of cars that are known to contain infected hogs should be required, to call attention to the necessity for thorough disinfection, before other hogs are shipped in same car.

This is probably sufficient to say in regard to the ordinary methods which should be applied in the control of hog cholera. Let us give the remainder of the time at our disposal to a consideration of protective inoculation by means of the "immunizing hog cholera serum."

THE USE OF THE "IMMUNIZING SERUM" AS A MEANS OF CONTROLLING HOG CHOLERA.

In the earlier part of this address, I expressed the opinion that the "hog cholera serum" will come into large use as an important aid in controlling hog cholera. This opinion is based upon the success which the serum has given when tested in a practical way, on a large number of farms, in various parts of the State; as well as upon the increasing demands for the serum wherever it has been used. In one month there were calls for ten thousand doses of the serum from Missouri farmers—calls for aid have come from sixty-nine counties during the past six months. Nor has the interest been confined to our own State; as calls for the "serum" have come from twenty-four other states. Only in a few exceptional cases mentioned elsewhere have we given aid to parties outside of the State; and much to our regret, we have at times been unable to give prompt aid to a considerable number of farmers in our own State. But even with the limited facilities which we at present have at the Experiment Station for producing the "serum," we have been able to demonstrate its value in thirty counties; and at the time of going to press, we have inoculated over six thousand hogs. This work, with only two exceptions, has been done on infected farms, and in herds where some of the hogs were sick and dying from cholera at the time the herd was treated. Complete reports from all these herds have not been received, but those at hand indicate that the losses have not been greater than 5% of the apparently healthy hogs that were in-



EXPERIMENTS ON INOCULATION OF SWINE Against HOG CHOLERA

By J. W. Connaway, D.V.S., M.D., Veterinary Department Missouri Experiment Station.

Map Showing infected territory and location of Field Experiments. April 30, 1909.

Symbols:-
+ calls for Serum, herds inoculated.
o -"- -"- -"- not -"-
• neighboring herds reported.
⊘ additional territory reported by Board of Agr. Crop reporters.

Data on Value of Missouri's SWINE INDUSTRY 1908.
No. Sold = 3,878,800.
Value = $38+ Millions
Farm Meat = 1,140,000
Value = $11 Millions
Breeding Stock 600000
Value $9 Millions
Total No. (est) 5,618,800.
Total Value (est) $58 Millions

Loss from Cholera.
Individual herds 80 to 90% often 50 to 100 head + Value $500 to $1000.00 loss in one pure bred herd in 1908 = $10,000.00
Loss in Counties: Atchison Co. farmers (est) 30%, Nodaway (est) 20% that is $50- to $100,000.00
Loss in State: at the low estimate of 5% the loss would not be less than $2,500,000 Annually

DATA - 81 Counties infected, 33 counties have not reported cholera in past six months. 69 counties have requested inoculation of herds with HOG CHOLERA SERUM. 30 Counties have received aid, but not to the full extent desired. 6541 hogs have been inoculated, in 134 herds, and the reports indicate that about 95% of the healthy inoculated hogs have not contracted Cholera although remaining on infected grounds.

Missouri River
Mississippi River
Atchison
Nodaway
Worth
Holt
Andrew
Gentry
Harrison
Mercer
Putnam
Schuyler
Scotland
Buchanan
De Kalb
Daviess
Grundy
Sullivan
Adair
Knox
Clark
Lewis
Platte
Clinton
Caldwell
Livingston
Linn
Macon
Shelby
Marion
Clay
Ray
Carroll
Chariton
Randolph
Monroe
Ralls
Jackson
Lafayette
Saline
Howard
Boone
Audrain
Pike
Cass
Johnson
Pettis
Cooper
Moniteau
Cole
Callaway
Montgomery
Lincoln
Bates
Henry
Benton
Morgan
Miller
Osage
Gasconade
Warren
St. Charles
St. Louis
Vernon
St. Clair
Hickory
Camden
Pulaski
Maries
Phelps
Crawford
Franklin
Jefferson
Washington
Barton
Cedar
Polk
Dallas
Laclede
Texas
Dent
Reynolds
Iron
St. Francois
Ste. Genevieve
Perry
Jasper
Dade
Greene
Webster
Wright
McDonald
Newton
Lawrence
Barry
Stone
Christian
Douglas
Taney
Ozark
Howell
Shannon
Oregon
Carter
Ripley
Wayne
Madison
Bollinger
Cape Girardeau
Butler
Stoddard
Scott
New Madrid
Mississippi
Dunklin
Pemiscot

oculated, although they remained on the infected grounds and exposed to sick hogs.

REPORTS FROM SWINE BREEDERS.

It will be of interest to give a few extracts from some of these reports—I shall confine myself mainly to reports from breeders of pure bred swine and other swine growers who are well known in the State:

Mr. Geo. M. Hoadley, Poland China breeder of Sedalia, Missouri, writes: "All my hogs that were not vaccinated have died.

Only two of the large ones, that were apparently well when vaccinated, have died; as these died in a few days after vaccination, they were probably already affected. I regret that the herd was not vaccinated sooner. If I show again I shall want my 'show herd' vaccinated before they go. I feel thankful to you for what you did, and wish you success."

W. Brook Cully of Bunceton, Cooper county, owner of the Spring Brook Poland China herd, after losing his herd boar, "Tecumseh Perfection" (the winner of the First Prize in the class of six-month-old boars at the St. Louis World's Fair), and a few sows and pigs from cholera, requested us to inoculate his herd with the "hog cholera serum." Several weeks later he wrote: "I am glad to be able to report favorably as to hog cholera. I have lost only two since you were here, and these were sick when inoculated." Forty-eight head in all were treated.

Ross Bros., Otterville, Missouri, Poland China breeders, who had cholera in their herd at the time of treatment, say: "Our thirty hogs that you inoculated on November 19 have done splendidly; they have shown no signs of the disease, though kept on the infected grounds where others had died."

Dr. G. M. Laughlin, manager of the Kinlock Farm, Kirksville, now president of the Missouri Swine Breeders Association, and a breeder of prize winning Berkshires, wrote: "Thanks for the serum which you sent us. I am well pleased with the serum, and am convinced more than ever that it will not only *prevent* cholera, but will *cure* it if used in large enough quantities. I believe where failures occur, it is the result of poor serum, or in cases where it is not used in large enough quantities. Our hogs are all at present in good shape."

Dr. Laughlin lost some valuable animals last year from the disease, the herd becoming exposed on the show circuit.

Mr. Thomas Richards of Vandalia, Missouri, breeder of high-class Berkshires, for whom we treated hogs last June, and who has since used considerable of the serum on hogs that he purchased and put on his infected farm, wrote as follows: "All of the hogs and pigs that were well when you treated them last June, remained well and healthy and have been so ever since." (At the time of my visit he had lost quite a number of hogs from cholera and several more were sick.) "In July I began to ship in hogs and pigs and vaccinate them and turn them out in the infected lots and pastures, and have not lost over 5% of all hogs treated. Have vaccinated, and now have on the farm over sixty head of registered Berkshires that I bought and shipped in since the outbreak last June. My experience has been that if treated before being exposed to the disease hogs may then be exposed *to any amount of cholera* and not over 5% will die. I may be over-enthusiastic about the value of the "hog cholera serum" you are preparing, but after losing over eighty head with cholera in less than thirty days, and then finding a remedy that has since saved me 95% of all animals treated, either aged hogs or little suckling pigs, I feel justified in being enthusiastic."

Mr. G. E. Leslie of Memphis, Scotland County, Missouri, Director of the American Poland-China Record, and owner and breeder of some of the most valuable animals of this breed in America, lost a part of his show herd last year at the close of the fair season. The others were saved by inoculation. That part of his home herd that was in greatest danger of becoming infected, was also inoculated with "protective serum." Only one of these became ill and died, whether from cholera, was not definitely determined. Every possible effort, however, was made to keep the infection away from the main herd by strict isolation of the diseased animals and thorough disinfection. The disease was stamped out without the spread of the infection to any of the surrounding farms. Mr. Leslie wrote: "I wish to thank you and assure you I appreciate what you have done for me."

Mr. Hugh Whiteford of Nodaway county, breeder of Poland China hogs, reported a month after inoculation, as follows: "Two of my old sows and several pigs, *which were sick when inoculated,* have died, but those that were well at the time of inoculation are still all right." These hogs all ran together on the same grounds.

Mr. Medsker of the same neighborhood reported two months later in regard to his herd: "The cholera was in my herd of hogs and I had lost fifty or more, when you came and vaccinated those not infected. Not one of the vaccinated hogs has died. I believe the serum a wonderful discovery, and wish you abundant success."

Mr. A. L. Perrin of Buckner, Jackson county, Mo., a breeder of fancy Poland China hogs, wrote: "None of the vaccinated hogs that were not off feed at the time of vaccination have been off at any time since. On the whole I am very much pleased with the results of our work." Eighty-two head were vaccinated. He had lost several hogs from cholera before vaccination and a number were sick at the time. The vaccinated hogs remained on the infected grounds.

Frank Schlotzhauer, Pleasant Green, Cooper county, Mo., had ninety head of hogs—good grade of stock hogs; thirteen of these had died before he requested us to use the immunizing serum on his herd. Twelve hogs were sick when the herd was treated. Sixty-five of the hogs appeared healthy when inoculated. A month later he wrote: "Not one of the sixty-five head you vaccinated took sick, fifteen of these were left in the lot with the sick pigs and have not shown any signs of disease. The remainder of the hogs were separated from the sick pigs only by a wire fence, and the smaller pigs could pass from one lot to the other and could easily carry infection."

Hall Bros. of Harrisonville, Cass county, write: "The vaccinated pigs in the pen with infected pigs are doing nicely and are thriving, have a good appetite and stay fat, while those not vaccinated are just the reverse. We have lost no brood sows nor boars since the vaccination. We feel under many obligations to the Department for the assistance, and are glad to have such a favorable report."

W. W. Waltmire of Cass county, a breeder and exhibitor of O. I. C. swine, reported good results from inoculation of his herd with the hog cholera serum; also Fantz Bros. of Cass county.

At the close of the fair circuit last year (at the American Royal at Kansas City) I treated hogs for several exhibitors from other states—among these were Mr. J. D. B. DeBow, Berkshire breeder of Nashville, Tenn., who had the misfortune to get his herd infected with cholera at some point on the show circuit. He had lost two hogs and several were severely ill when the show herd was inoculated. The sick as well as the apparently healthy hogs were injected with the "Hog Cholera Serum," and with the exception of two animals were immediately shipped home. Some of those which were sick when inoculated, died. The shake-up of the long journey probably hastened the fatal issue. Several of the show hogs, however, were saved. He writes as follows: "I am glad to say that my two great boars, "Premier Longfellow's Rival" and "Ravenwood Masterpiece" were two of those that were never sick a day. Six of the vaccinated sows were also saved. I am sure if you could have vaccinated the entire herd before shipping them from home, that none of them would have gotten sick. I hope next year to have my entire herd vaccinated before I start on my trip. It will be a great pleasure to send them back to Missouri, where I was so well treated."

Mr. Lester Sturm, a Berkshire breeder of Vandalia, Illinois, was another exhibitor whose herd became infected with cholera while on the show circuit. Several of his hogs were sick when the herd was inoculated. Some of these sick animals died on the way home, from the disease and the disturbance from shipping. Those, however, which were apparently healthy when inoculated did not show any evidence of the disease after their arrival home. He saved his two herd boars and several sows. The show herd was quarantined on arrival home, but by some accident the infection spread to the home herd and a few of these died, the remainder were inoculated with the "immunizing serum," and but few more animals of the herd died. Mr. Sturm reported as follows: "I will give you a detailed report soon, but for the present will say that the vaccination has been highly gratifying to me and everything in my herd now seems to be healthy and eat good. My losses after vaccinating were very small. I certainly feel very grateful to you and your Experiment Station for what you have done for me."

If further evidence were necessary to convince you that this serum has practical value as a means of preventing cholera, I could add reports from such men as the Harrimans, Ben Harned, Judge Davin, and many others of Cooper county; the Hughes Bros. (and neighors) of Glasgow, Howard county; R. F. Aulger, F. L. King and G. T. Reid of Sweet Springs, Saline county; the Glendenning Bros. and John Hansbrough of Marion county; S. P. Emmons, M. D. Porter and others of Audrian county; Bush Rust and neighbors of Hardin, Ray county; H. H. Harshaw and W. H. Charters, Poland China breeders, of Bates county; W. F. Wheaton and others of Pettis county; Joseph Lynes, Matt Turner, Joe Estes, John Daily, Lewis Young and others of Boone county; R. T. Lindsay of Henry county, as well as one or two farmers from several other counties.

I would not have you think that we have experienced no difficulties, and that the results were in every instance as favorable as those given. In the herd of Mr. A. L. Miller, an O. I. C. breeder of Jackson county, the hogs continued to die for a week or ten days after inoculation. The form of disease on this place was very virulent and no doubt some of the animals that were inoculated were infected at the time, although not showing any marked outward signs of the disease. The number, however, that died after the inoculation convinced me that the serum used on this herd was probably not of proper strength. We had not tested it before using. Another unfavorable condition was that the weather was bad and the animals were not sufficiently protected against the winter storms. It is possible that a large number of the animals would have recovered if they could have had dry, comfortable quarters, so that pneumonic complications could have been avoided.

Another instance is that of Mr. Bradford of Boone county, who lost quite a number of his Berkshires. The disease appeared during the worst part of the winter. The greater part of the herd was infected at the time of vaccination. Sick ones as well as those that were apparently healthy were vaccinated, as we wished to test the curative effects of the vaccine as well as its preventive properties, and to save as many of his valuable animals as possible. As has been our experience in other cases, the greater part of those that showed well developed signs of sickness succumbed to the disease; and in this case, a number of others which would no doubt have resisted the disease under better weather conditions, also, died, either from the direct effects of the cholera or from pneumonia induced by exposure to cold while in a weakened condition. It was impossible under the conditions to provide dry, comfortable quarters for the large number of hogs in his herd. Mr. Bradford holds the same opinion that we do, that the unfavorable result was due to the fact that owing to his absence from home, the herd was not inoculated until most of the hogs were already sick, and the exposure to the winter storms caused many of the sick hogs to develop pneumonia.

The unfavorable results in his own herd under the conditions mentioned, has not caused him to lose faith in the efficacy of the "serum" as a valuable "preventive," as he has knowledge of the good results from the use of the serum in the infected herds of some of his neighbors.

I recall another case in Marion county, near Palmyra, where we inocculated a lot of feeding hogs, on the farm of J. W. Mackey, where quite a number of hogs had already died. (I found eighteen head thrown in a ditch at the back of the farm. The partially decomposed carcasses we at once disposed of by burning). Of the remaining animals of the herd, two, which were severely ill, were killed for diagnostic purposes. Both showed the acute hemorrhagic type of cholera. The remaining 67 head were treated with serum; some of these showed red blotches on the belly, or other signs of the disease. How many more were already infected at the time of inoculation it would be difficult to estimate. These hogs were following cattle on "full feed," and the feed yards at this time were deep in mud. The cold storms of January soon followed, and the effects of the disease and exposure were disastrous to many of the inoculated animals. The owner reported three weeks later that twenty head had died and a few more were "drooping around." Some of these hogs no doubt died from pneumonia resulting from exposure to the winter storms while in a weakened condition. Of sixteen breeding hogs, which received better care in the way of shelter during the "cold spell," only one was reported sick; and this one was in an unthrifty condition when inoculated.

In the same county, and on the following day three other herds of stock hogs kept for breeding purposes, were inoculated on the farms of William Glendenning, Thos. Glendenning and Mrs. Young. In all of these herds a number of hogs had already died, but following the vaccination none of those which were apparently healthy at the time of vaccination showed any signs of cholera afterwards, though left on the infected ground. These herds, however, were small and received better protection from the storms. They were kept in dry, comfortable quarters during the severe weather. It therefore seems that in applying this method to lots of "feeding hogs" which must run on infected grounds where the conditions are such that thorough disinfection is extremely difficult or impossible, the proper method will be to vaccinate the hogs before they are exposed to the infected grounds, and, if possible, have them immune before cold weather begins.

The evidence which has been quoted from well known breeders of pure-bred swine, and other swine growers, as to the good results of the practical tests of the "hog cholera serum" which have been made on their farms, and under varied conditions, strengthens the confidence which previous experimental work had given us, that we have in this "serum," when it is properly prepared and properly used, an exceedingly valuable means of preventing cholera.

The main problems now before us are: *The production of a sufficient quantity of a reliable serum to meet the needs of the State, and the devising of a plan to be followed in using the serum. which will secure the best results for the swine industry of the State as a whole, and which has for its aim the ultimate eradication of the disease.*

We realize that it would be an enormous task to undertake the production of sufficient "hog cholera serum" to immunize all the hogs in the State. But to control hog cholera this would be no more necessary than it would to immunize every child in the State against diphtheria in order to control that disease. It will be necessary to inoculate only a comparatively small number of hogs in any neighborhood, if the disease is recognized soon after it appears and prompt action is taken. The disease does not originate spontaneously, but is carried in from some outside source, whenever it appears in any place where it has not previously existed; or reappears on grounds that have been disinfected. The prompt inoculation, therefore, of the first herd that becomes infected, and a few herds on adjoining farms that are most liable to become infected, will, in most cases, stop the further spread of the disease, if proper precautions are also taken by the farmers and veterinarians to quarantine and destroy the infection on the farms where the disease first appears.

I will mention an instance in my own work where by such means a wide spread outbreak was probably prevented. One of the well known swine breeders and exhibitors of this State had the misfortune to bring the disease to his farm in his "show herd" that was exposed to the infection at a live stock exhibit one hundred miles or more from his farm. As a precaution against infecting the home herd, these infected animals were quarantined and inoculated with the "hog cholera serum." Some of these "show hogs" were saved, but those that were severely ill, died. The home herd was also inoculated, and only one of these became sick and died; whether from cholera was not definitely determined. The disease was stamped out without a single case occurring in other herds of the neighborhood. No other cases of cholera existed in the county so far as known, and none has been reported since that time. One of the deputy State veterinarians who assisted in this work, has kept a close watch for several months for the appearance of new cases.

In this case prompt action and the use of a comparatively small quantity of serum probably prevented a wide spread outbreak that would have resulted in great loss and required much time and labor to suppress; and which would have required the use of a thousand or more doses of serum. In this case due credit must be given to the stringent quarantine and disinfection measures which, upon my advice, were carried out by the owner.

In contrast to the above, the disastrous results which follow, when, from any cause, the disease is not recognized early, and prompt steps are not taken to inoculate the herd with the protective serum, and to apply appropriate quarantine measures to prevent the spread of the disease to other farms, is well illustrated by another outbreak of cholera which originated in exactly the same manner as the one mentioned above. This outbreak occurred in a herd that had been on the "show circuit," but as the animals appeared healthy when they arrived home, they were not put in temporary quarantine, but were allowed to run with the main breeding herd. In a few days the "show" hogs became ill and were separated from the breeding herd. They had, however, already spread the infection widely over the hog yards and pastures; and the disease spread rapidly through the entire herd, causing the owner great loss. The infection moreover spread from this farm to several others in the neighborhood; and from these was carried by traffic and other means several miles from the original focus of infection. This outbreak occurred a year before the one mentioned above, and at a time when sufficient "serum" was not available to inoculate the herd. Since then, however, the disease has been kept under control on several of these infected farms by use of the "hog cholera serum," and a few of the farms now appear to be free from infection. Had it been possible to inoculate the herd, in which the disease first appeared, at the beginning of the outbreak, with a potent serum, the losses which fell upon this breeder and upon many farmers of the same county, would not have occurred. Nor would it have required such a large quantity of serum as has since been used.

The importance of prompt action and proper procedure is well illustrated by the two outbreaks mentioned. The infection, however, is at present so widely distributed over the State that even with the most prompt service, a very large quantity of serum will be required to control the disease on the farms that are now infected, and to prevent the infection of new territory. It is evident that if proper progress is to be made toward the eradication of this disease, *the State must produce the serum* in order to ensure a reliable product and a sufficient quantity for official use, and for private use under official sanction. The serum should be supplied either free of cost or at a nominally low charge. This is necessary to protect the swine growers from "fake" products that may be put on the market by irresponsible empirics; and to protect them from extortionate prices by commercial producers who may put on the market a legitimate product. We share with Dr. Melvin, Chief of the U. S. Bureau of Animal Industry, the opinion that the proper agencies for the production of this serum are the laboratories of the Veterinary Departments of the State Colleges of Agriculture; which, with their close association with the Ex-

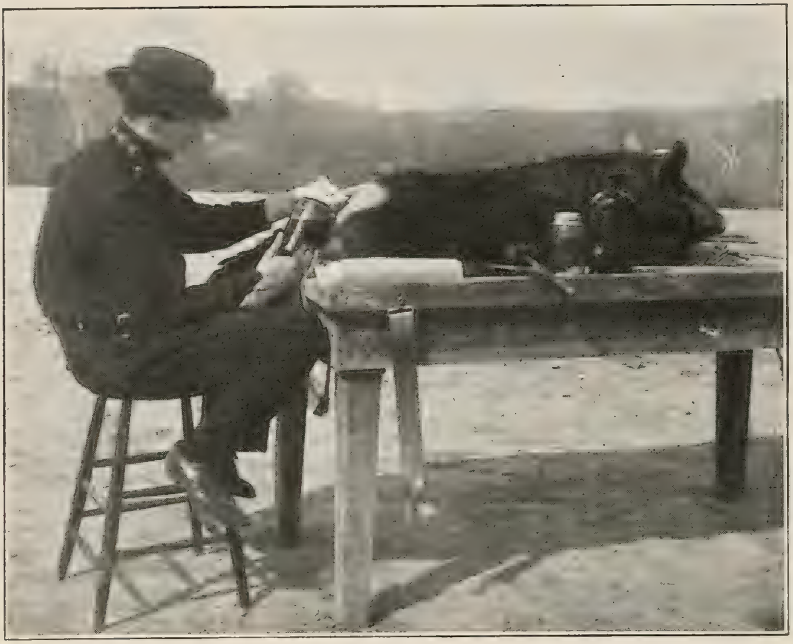


Fig. 7. Showing method of drawing blood from a "hyperimmune" hog for preparation of "Hog Cholera Serum."

Veterinary Department, Missouri Experiment Station.

periment Stations, can carry on further researches looking toward the improvement of methods and cheapening of the cost.

The State, through these agencies, can well afford to produce the serum free of cost as a means of conserving resources which are now lost to the State to the amount of millions of dollars.

The production of a reliable serum is a necessity for use in official work in suppressing this disease, and cannot, with safety, be entrusted to private concerns or to men who have not had proper training in laboratory and surgical technic, and a special training in this particular work; as well as a good knowledge of the pathology of hog cholera and other swine diseases. The work we have done has not been without mistakes and accidents, notwithstanding the large experience we have had. In a few instances the supply animals were evidently not sufficiently hyperimmunized to render the serum protective; in another instance, owing to the pressing demands from the farmers for the serum, and our haste to meet these demands as promptly as possible, some of the supply animals were probably drawn upon too heavily, and the serum weakened. In other cases a few of the supply animals that were about ready for supplying serum died from Septicaemia (blood poisoning), due to the contamination of the virus used for hyperimmunizing them. Hence, the necessity for careful bacteriological work to prevent such accidents. If, with the care we try to give this matter, some mistakes are made, what may not happen in the hands of empirics whose ideas of immunity are crude, and whose technic is faulty?

While the serum as at present produced has, in the great majority of cases, given excellent results, we hope to still further improve the methods of production and increase the potency of the serum in order to cheapen the cost, increase the quantity and lessen the dosage. In the work of the past year we have learned how to produce a larger quantity than formerly, and even if the horse and ox should not prove of practical value as producers of hog cholera serum, the hog will still remain of sufficient practical value as a producer of the serum to continue in service, despite the disadvantages of the smaller quantities of serum supplied. An animal that will supply every week or ten days from 90 to 100 doses of serum is worth his care and feed, and while the expense of producing the serum by this method renders it unattractive to the commercial vaccine producers, its use by the State in an official way for the suppression of outbreaks, which would otherwise become general and cause great loss, makes it cheap, since the cost is distributed among the many who are benefited through the suppression of the disease early in the outbreak, in neighboring herds.

On account of the comparatively limited quantity of serum which we have up to the present produced, it has necessarily been used mainly to demonstrate its value under varied conditions, in as many parts of the State as possible, for purely experimental and educational purposes, and not in a systematic way to completely eradicate the disease in any badly infected district. Under the present conditions we have deemed it wise, in using the serum, to give preference to certain classes of swine over other classes, just as the farmer would do if he were the owner of the several classes; that is, we have given preference first to the "registered" breeding herds that were suffering from the disease; then to the breeding stuff of the common herds, the sows and boars that are to be retained on the farms; next the young immature swine that are unfit for market; and last the hogs in the "feed lot." In an emergency, the last mentioned class can be put on the market and some profit realized, while in the other classes the sacrifice would be much greater. As a matter of wise economy, it seems to me that the State cannot do better than to provide the means for protecting all the classes of swine mentioned—the "feed lot" herds as well as the "registered herds"—means sufficient to carry on the work in a well organized, systematic way looking to the *complete eradication of the disease.*

Policy and Plans in Field Work.—The main object in the production and use of this serum, from the point of view of the State, is not so much to aid any particular individual who may be losing hogs from cholera, *as to eradicate the disease in the shortest time possible in order that the infection may not spread to a large number of other herds, and thus result in a general outbreak that may prove disastrous to a large number of tax payers.* In the use of the serum in field work, this main purpose should always be kept in mind. It is evident that the greatest good can be accomplished by sending veterinary officials who are properly trained, to the seat of every outbreak to investigate the extent of the disease, and locate every focus of infection. In addition to inoculating the hogs on the infected farm, it is the duty of the veterinary official to give the owner of the herd such instructions in regard to methods of quarantine and disinfection as are necessary to prevent or limit the spread of the disease to other parts of the same farm, and to the farms of neighbors—such instructions as are given in the first part of this paper.

The inoculation of healthy herds on neighboring farms may also be advisable in many cases where, on account of drainage or other circumstances, it seems difficult to confine the infection to the farms where the officer finds it.

It has been my practice, when called to a locality where an outbreak of hog cholera has occurred, to enlist the interest of the local veterinarian in this work, in order that he may aid in the suppression of outbreaks of that disease when they occur in his field of practice. Several veterinarians in the State have already done good service in using this serum. Some of these were official deputies, others in private practice. In some instances good service has been rendered by farmers whom we have taught how to diagnose cholera, and how to use the serum. In so large a problem as the control of hog cholera efficient veterinary aid is not always available, and the co-operation of the farmers is both necessary and advisable.

Protecting of "Show Herds" by Serum inoculation.—As already mentioned, fairs have many times in the past been the distributing points of hog cholera infection, in spite of vigilant care on the part of the management—through the ignorance or carelessness of an inexperienced exhibitor or his herdsman in not guarding against infection at the home station or en route. Protection against these dangers, I am confident, can, in a great measure, be secured by inoculation of the "show herds" with the immunizing serum before the swine are shipped from home. This should be done with a tested serum, made and used under State supervision.

I was solicited last year by a few exhibitors to inoculate their "show herds" before they were taken to the fairs; this was not done because the parties did not apply for the aid until a short time before shipment. The inoculation should be done two or three weeks before shipping, so that any soreness, which, in rare instances, occurs from the inoculation, will have disappeared before taking the animals into the show ring.

Several exhibitors who lost hogs from cholera last year intend to have their show herds inoculated this year before starting on the fair circuit.

Secretary Stinson of the State Fair Board, in a letter to me on this subject, expressed the hope that all exhibitors will take this precaution. The offer is here made by the veterinary department of the College of Agriculture, to supply free of charge the serum and the services of a competent man to inoculate all herds that are entered for exhibit at the Missouri State Fair or the American Royal during the coming autumn, provided that the exhibitor pays the traveling expenses of the man who is sent to do the work. By this means the great losses from cholera, such as have fallen on exhibitors in past years should be prevented, as well as the danger of spreading the disease to other herds in various sections of the State. All who intend to avail themselves of this service should make this known to Secretary Stinson, or to us, several weeks before the opening of the Fair, so that we may provide the serum for this special service, and have time to visit the farms of all who desire the work done. It should not be understood that the State Fair Board will make inoculation against cholera a requisite for entry, but simply advise it in the interest of the exhibitor. I am sure that the Fair Board will not relax in the least the sanitary measures that have been carried out in the past to secure clean, healthful quarters for the housing of the swine entered for exhibit.

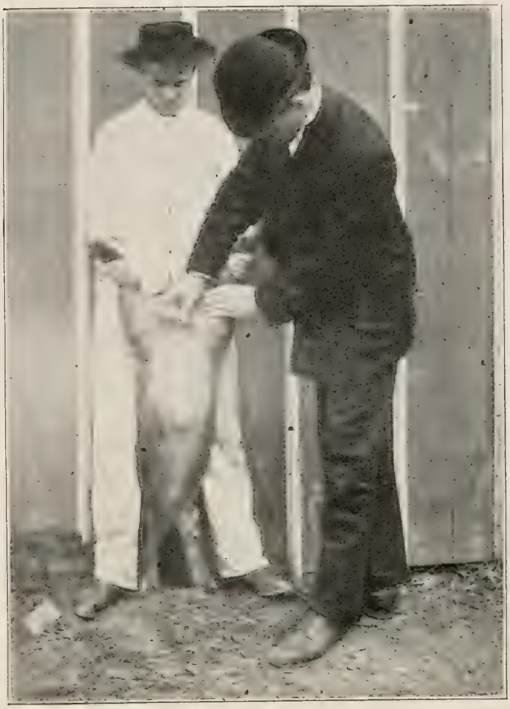


Fig. 8. Method of inoculating pigs against hog cholera.
Veterinary Department, Missouri Experiment Station.

DOSAGE AND TECHNIC OF INOCULATION.

The dosage varies according to the size of the animal: The ordinary dose is twenty cubic centimeters for hogs weighing from fifty to one hundred pounds, and twenty cubic centimeters for each additional hundred pounds; and ten to fifteen centimeters for pigs under forty or fifty pounds.

The immunizing serum is injected by means of a hypodermic syringe—one of twenty cubic centimeter capacity is best. It should be provided with a heavy slip needle. Pigs and small shoats are held in the manner shown in illustration. The hind legs of the pig are elevated sufficiently to bring the inner surface of the thigh to a convenient height for the operator. The attendant holds the head and front part of the body of the pig between his feet. The belly of the pig is turned toward the operator. The site of the injection on the fleshy part of the inner face of the thigh is cleaned by means of a bit of cotton or a sponge dipped in a 5 per cent solution of carbolic acid; the needle is thrust through the skin *into the muscle,* and the serum is slowly injected. It is best to divide the dose between the two sides. The serum is absorbed better when injected into the muscle rather than simply underneath the skin. Heavier hogs which cannot be held in the manner described, are laid on the ground and turned on the back. The hind legs are held backward, and well apart, and the injection is made in the same location as in the smaller hogs. When pregnant sows are to be inoculated they are not thrown down, but are confined in a crate, or by other convenient method, so as to avoid rough handling, and are inoculated just back of the ears, in the deep vertical furrow which lies between the head and the shoulders. A gentle sow can be inoculated in this location without confining. The thigh muscle is ordinarily to be preferred to this location, as the absorption is better.

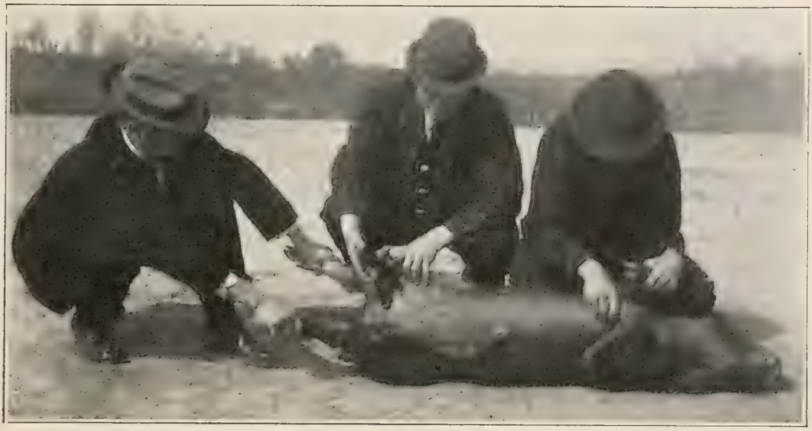


Fig. 9. Method of inoculating a large hog against hog cholera.
Veterinary Department, Missouri Experiment Station.

DURATION OF THE IMMUNITY.

When the hogs are injected with the immunizing serum alone a passive immunity is conferred which probably does not persist for more than three or four months. If the hogs are on infected grounds at the time of inoculation, they will acquire a permanent immunity. If the animals are on grounds that are not infected, it will be necessary to inject them with a small quantity of hog cholera virus (about two cubic centimeters). This was called by Dr. Dorset the "simultaneous method." In the greater part of the over six thousand inoculations which we have made, the herds were on infected grounds, and it was not necessary to use

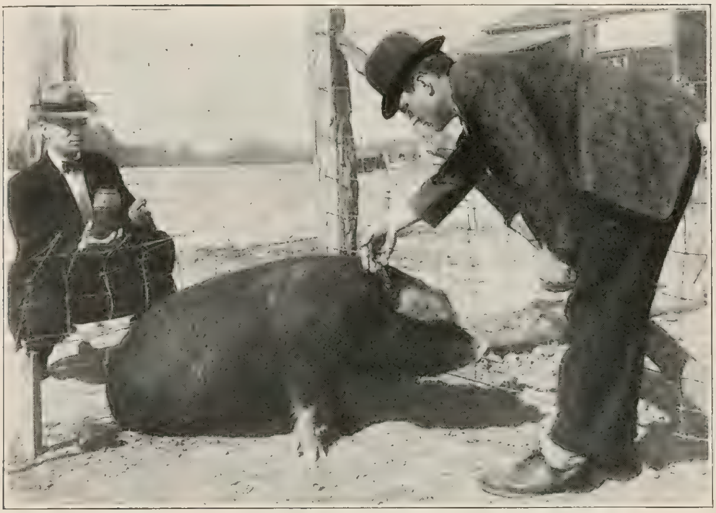


Fig. 10. Method of inoculating a brood sow heavy with pig.
Veterinary Department, Missouri Experiment Station.

this method to insure permanent immunity. Breeders whose farms are free from infection prefer to re-inoculate their "show" animals with the serum alone, rather than use the simultaneous method; so as to avoid a possible risk of infecting their farms.

Losses From Cholera.—In this connection it may not be out of place to mention that, although the full extent of the drain which hog cholera entails upon the swine industry cannot be accurately estimated, data at hand show that the losses in many individual herds in this state have run from $2,000 to $5,000 during the past year; and in one registered herd the loss amounted to more than $10,000. It is safe to say that single counties have in some years suffered a loss of $50,000 to $100,000 from this disease, counting the deaths of hogs, depreciation of profits from putting immature stock on the market, and the inconveniences and hardships that have fallen on many, who, except for this disease had planned wisely on borrowed capital.

A conservative farmer of Nodaway county estimates that the mortality from hog cholera in that county in the individual herds that are attacked is about 90%; and for the entire county fully 20% of all the hogs die from this disease. Another prominent farmer of Atchison county writes: "I think that fully 30% of the hogs of this county die from cholera; this estimate, if anything, is below rather than above the actual figures." The enormous losses in that one county can be realized when it is known that besides the breeding stock that was retained on the farms, over 75,000 head of hogs were marketed in one year, from which basis we can estimate, with even a less per cent than that given, that from twenty to twenty-five thousand pigs died. No doubt quite a number of the hogs that were marketed were immature, and were shipped out on account of the disease; on these an additional money loss was sustained.

Putting the loss from hog cholera for the entire State at the very low figure of 5 per cent., it is estimated that the loss in money amounts to not less than $2,500,000. It will certainly not run less than a half million dollars any year, and in some years four or five times that amount. The prevention of such a waste of the State's resources is well worth the best efforts that can be made by this Department, and I am sure that the members of this Association, as well as many other farmers and stockmen of the State, appreciate what we are trying to do and will give us their hearty encouragement.

If, with the meagre facilities and limited funds with which we have worked, we have been able to inoculate over six thousand hogs in thirty counties, and to demonstrate to the farmers the value of this hog cholera serum in such a convincing way as to arouse their enthusiastic interest, it seems reasonable that if this Department is provided with proper equipment and funds so that the work can be carried on in a proper manner at all seasons of the year, without interruption, the expectations of the farming public in the matter of the control of hog cholera can be reasonably met. Instead of operating in thirty counties in a very incomplete way, the sixty-nine counties that have called for aid in suppressing outbreaks of cholera should have been covered, and in a thoroughly efficient manner. Instead of having used six thousand doses in several months, we should have used ten thousand doses or more in one single month during the worst part of the season.

PROPRIETARY REMEDIES.

I think it important in this address to mention certain proprietary remedies, which are now before the public, one of which has recently been put on the market and has been tried extensively by a number of the veterinarians of the country. I refer to the product called Bruschettini's hog cholera vaccine. The distributor (Sorby Vaccine Co. of Chicago) claims that this material is manufactured in Italy, and that in that country and in several of the smaller states of Southern Europe (Roumania, Servia, Bulgaria, Bosnia,) it has been used with great success for ten years. Such claims are probably overdrawn; since, if they were true, countries like Germany, Austria-Hungary, France, England, Switzerland and Denmark would long ago have adopted this vaccine; as all these countries suffer from hog cholera, and are far more advanced in veterinary matters than Italy, and the other unimportant states mentioned. Moreover, tests made by the U. S. Department of Agriculture, and reported in circular No. 27, show that samples bought on the market and used according to directions by competent veterinarians failed to protect hogs against cholera. I have had an opportunity to note the lack of value of this foreign vaccine in neighborhoods where several hundred hogs had been vaccinated, and have reinoculated with success some of these herds with the "immunizing serum" which we produce at the Experiment Station.

One farmer was of the opinion that this Italian vaccine gave his hogs the disease; as the herd was perfectly healthy before vaccination. Such an accident could happen by the use of a "vaccine" not sufficiently modified, since a vaccine, unlike the "antitoxic serum," is made from disease-producing germs, by various processes of weakening their virulence. There is the possibility, however, that the disease was carried in from infected farms in the neighborhood. Whatever may be true in this particular case, we should not overlook the possibility of giving cholera by the use of these foreign vaccines when improperly modified. But a matter of much graver concern is the possibility of introducing an entirely new swine disease into this country, namely, the "swine erysipelas" of Europe (the "rouget" of France and "Schweine Rothlauf" of Germany), a disease which, up to the present, we have fortunately escaped. Since "swine erysipelas" is very prevalent in Europe and occurs in herds at the same time with cholera, it is quite possible that the so-called vaccines which are sent to this country for use against cholera, may also contain the germs of the "swine erysipelas," and through these vaccines infect the hogs of America. In my opinion, such vaccines should be as rigidly quarantined against as "foot-and-mouth-disease," until their harmlessness has been thoroughly established by the proper authorities, namely, the U. S. Department of Agriculture, charged with the duty of preventing the introduction of animal diseases from foreign countries.

There is another method called the "Ridgway Process," which consists in feeding infectious material to pregnant sows, which are already immune, and to the pigs for a while after farrowing. This is a method that should be avoided for the reason that it requires the use of infectious material in a manner that is dangerous to neighboring swine raisers who do not have immune hogs; and it is questionable whether it immunizes the pigs on the farms where used. The aim of the swine raisers and the veterinary officials should be to *destroy* the hog cholera infection on the farms instead of propagating it. The theory of the Ridgway process necessitates the maintenance of the disease on the farm.

We have also been called to reinoculate hogs that had been "vaccinated" with "Bannerman's fluid," which material had proven to be valueless.

It is hardly necessary to mention the proprietary medicinal mixtures which are sold as preventives and cures for hog cholera: the basis of nearly all of these mixtures is the old Government formula contained in "Farmers' Bulletin No. 24, U. S. Department of Agriculture. Some of the mixtures that vary from this contain a small quantity of arsenic, or copper sulphate (blue vitriol). The Government formula was never recommended as a specific. It is useful, however, as a laxative, intestinal antiseptic, and febrifuge. The various proprietary remedies that are patterned after this formula are, no doubt, useful in the same way; but the farmer pays dearly for the mixing of cheap ingredients.

DISCUSSION.

Q. How do you disinfect?

A. By thoroughly liming the pens.

Q. Will not crows and buzzards carry infection?

A. Yes. Use a "shot-gun quarantine" against these.

Q. What would be the cost to the farmer of having his hogs inoculated?

A. We do it free of charge. We do it *not* for your individual good, but for the good of the community and for the good of the State, to prevent the spread of infection, just as we handle a case of glanders or any highly infectious disease. It is not a matter of individual interest, but of *state* interest. So we believe it to be proper that you report the outbreak of cholera promptly to the State officials, and a veterinarian will be sent to your place to handle the disease, as if it were glanders or any infectious disease; probably not with that rigid quarantine and slaughter of animals, but in a manner which we think will best protect your herd and other herds of the neighborhood.

Q. You speak of burning the hogs. My experience has been that the other hogs will eat them as soon as they get to cooking. Will that spread the infection?

A. When the dead hog has become hot enough to kill the germs it does not hurt at all. The well cooked meat is helpful for them; but it is probably not best to allow the other hogs to eat them, especially the intestines, as the heating is not always sufficient to kill the infection.

Q. What do you suggest as to the prevention of this disease? Do you propose to go about over the State curing the disease, and then let the hog breeders be careless or indifferent?

A. We expect the swine raisers to do their part in every way possible to prevent the spread of the disease, by the quarantine and disinfection measures, which I have already mentioned.

Q. Have you any knowledge in your years of experience of a herd where cholera had broken out spontaneously, caused by local conditions?

A. Cholera does not originate spontaneously; the seeds or "germs" must be brought in and planted. Wheat will not grow on a field unless you plant the seed of wheat, nor potatoes unless you plant potatoes. Sometimes cholera seems to come into a herd spontaneously, but if the matter is investigated thoroughly the source of the outbreak will be found in one of the several ways I have already mentioned. A dirty barn won't produce it unless you put the diseased germs into that barn.

Q. How long, from the time a hog is exposed to cholera, will it be before the disease develops?

A. From 9 days up to 60 days. I have known the disease to break out in some "show herds" sixty days after they got home.

Q. How long do you keep the herd quarantined when you return from the show?

A. Fully thirty days. The disease will usually show up in that time. If one of the animals should show signs of the disease, put it off to itself. It may not have cholera, or it may be a very mild form of the disease like some mild cases of typhoid (called walking-typhoid). A person may carry the typhoid germs in his body and spread infection to other people and still not show any well marked signs of the disease himself; and in hog cholera, a very mild case of the disease may pass unnoticed and give rise to an outbreak sixty days and even longer after the infected animal has been brought in. A very small amount of the infection being spread on the ground, by a mild case, the disease does not develop rapidly; on the other hand, if it is a very acute type the disease develops rapidly.

Q. How long will the germs live in a lot where there is no disinfection?

A. Several months, sometimes. Sunshine, however, is a good germ killer.

ECONOMICAL PORK PRODUCTION.

(C. A. Wilson, Instructor in Animal Husbandry and in Charge of Swine Investigations, University of Missouri.)

The solution of our problems in pork production will involve whole systems of farm management, but we shall only consider in this short article a possible solution through the use of forage crops. Data collected from short feeding trials by experiment stations heretofore would seem to indicate, in the light of present high priced feeds, that the production of pork is quite an unprofitable vocation. A general resume for instance, of experimental data shows that it requires from four to six pounds of grain to produce a pound gain, which at the present high prices of foodstuffs would make the cost of production from $4.00 to $6.00 per hundred weight increase.

The general conclusion has been that it requires to produce one pound of gain with steers 7.4 pounds of digestible organic matter in the ration; with sheep, 7.2 pounds; with poultry, 5.1 pounds, and with hogs, 3.3 pounds. If we can produce, then the pound gain, in the case of pork with 3.3 pounds of as cheap digestible organic matter as that with which the cattleman produces his pound gain, with 7.4 pounds digestible organic matter, there will be no question as to the economy in pork production.

As startling as it may seem, when hogs sell for from five to seven cents a pound live weight, the farmer cannot afford to sell his corn for seventy cents a bushel. Under proper systems of management we may obtain seventy cents per bushel and even more for the corn that is fed. We shall have to learn that hogs are more adapted than we had supposed in times past for consuming roughages and forages, and then supply them. The undomesticated hog is not limited to the use of grain as his ration, but makes use of the succulent roots, herbs, and plants that are within his domain. If we then can supply him with succulent leaves and roots we will be supplying him with a food to which he is adapted and one which will also lessen the total cost of production.

If we can, in the 3.3 pounds of digestible matter required for a pound gain, supply one-half or two-thirds with such green forages as clover, rape, cowpeas, rye, soybeans, sorghum and corn, we should be able to produce pork at a net cost at marketing time of two to four cents. That we can do this is partly borne out by the results obtained at our own Station during the season just past. The Missouri Experiment Station found during the season of 1908 that when hogs are worth five cents a pound

An acre of clover may be worth $25.77,
An acre of rape and oats may be worth $28.60,
An acre of cowpeas may be worth $14.23, and
An acre of rape alone may be worth $13.20.

These results show the possible net returns per acre where pork is produced on green forages.

(The bluegrass lot in this particular experiment gave no net returns.)

These forages were in each instance supplemented with about one-fourth full feed of corn, and, supposing the rental value of each plot to be $3.00 per acre, and pork to be worth five cents, the following prices were obtained for the corn fed: With the blue grass lot 49.9 cents per bushel; with clover forage, 100 cents per bushel; with cowpeas, 98.8 cents per bushel; with rape, 77.5 cents per bushel, and with rape and oats forage, 83.2 cents per bushel. These figures show in another way the possible values of corn when fed as a supplement to a forage ration.

To state the results in still another way, it was found for the season of 1908, that on the blue grass plot the hogs required 5.4 pounds of corn to produce a pound gain; with clover forage they required 2.64 pounds; with cowpeas, 2.90 pounds; with soybeans, 2.61 pounds; with rape, 3.52 pounds, and with rape and oats, 3.3 pounds. These data show that under similar conditions there is not much difference as to their value pound for pound of clover, cowpeas, soybeans, rape or rape and oats, when corn is supplied as a supplement, and that the value then of one forage as compared with another will be determined by its adaptability to different soils and seasons and to withstand pasturing. The value of each will be determined by the amount of forage that each will produce for a whole season while being pastured. Each may have its particular place in a rotation of forage crops.

A seeming lack of adaptability of forage crops to lend themselves well to rotation systems has, perhaps more than anything else, mitigated against the general use of especially provided forage crops for hogs. They do, however, when carefully planned, lend themselves well to systems of crop rotation.

The difficulties involved in planning forage crop rotations are, first, to meet requirements at all times of the forage season; second, to select the forage adaptable to the particular class of animals to which it is to be fed; third, to so arrange the system that the amount of labor will be evenly distributed throughout the season; and, fourth, to conserve and to increase as rapidly as possible the fertility of the soil. These requirements may be well met under varying conditions by some of the following two, three or four year crop rotations.

To secure the best results with forage crops and to build up the soil fertility to the greatest possible extent, it is necessary in any crop rotation that there be introduced a leguminous or nitrogen storing crop. One of the most perfect nitrogen storing crops that we have is red clover, which is also one of those most adaptable for swine feeding purposes. For average conditions the following rotation will perhaps be the most nearly ideal:

ROTATION NO. 1.

1909—Corn and rye	Rye and clover	Clover.
1910—Rye and clover	Clover	Corn and rye.
1911—Clover	Corn and rye	Rye and clover.

It is intended that a part or all of the corn shall be hogged off in the fall. At the last cultivation plenty of rye should be sown. The rye will add to the pasturage somewhat in the fall, while the corn is being hogged off, and should be allowed to ripen in 1910, and fed off without cutting. The clover seed should be sown in the fall, and if a good stand is not obtained a second seeding should be made in the spring. This will give considerable clover forage in the fall of 1910 and clover for forage in 1911. This rotation may be varied in a great variety of ways. For example:

ROTATION NO. 2.

1909—Corn and rye	Rye and rape	Soybeans.
1910—Rye and rape	Soybeans	Corn and rye.
1911—Soybeans	Corn and rye	Rye and rape.

This is essentially the same as the first rotation given, except that instead of clover, soybeans is introduced into the system. Rape is sown with the rye in the spring and lightly harrowed in, and the hogs are rung and turned in when the rye is ripe.

ROTATION NO. 3.

1909—Sorghum	Rape, oats and clover	Clover.
1910—Rape, oats and clover	Clover	Sorghum.
1911—Clover	Sorghum	Rape, oats and clover.

Rotation number three is again quite similar to rotation number one, with the exception that sorghum is used in place of corn. This rotation is perhaps more adaptable to the southern portions of the State. Rape, oats and clover are sown in the spring as soon as danger of frost is over, and are sown in the following proportions per acre: Rape six pounds, oats one-half bushel, clover six pounds.

ROTATION NO. 4.

1909—Corn and rye	Soy beans.
1910—Soybeans	Corn and rye.

This rotation is a two-year rotation. Rye is sown as before at the last cultivation, and is used in the following spring for early forage, and may be used up to June 8th or 10th, at which time it is intended to be plowed up and sown to soybeans or cowpeas.

ROTATION NO. 5.

1909—Rape and oats	Cowpeas.
1910—Cowpeas	Rape and oats.

This is also a two-year rotation and is intended for smaller fields than the other systems given. The rape and oats should be sown in the spring as soon as frost is over, in the following proportions per acre: Rape six pounds, oats one-half bushel. In this rotation if it is desired to have something sown on the land to serve as a soil and fertility binder during the winter, it may be advisable to sow the rape and oats plot late in the fall to rye, which may be used early the following spring for early forage, up to June 8th or 10th, when the cowpeas should be sown.

Where in diversified farming it is desired to introduce a grain crop, not to be fed off as forage, the following rotation may be advisable:

ROTATION NO. 6.

1909—**Corn**	Grain	**Clover.**
1910—Grain	**Clover**	**Corn.**
1911—**Clover**	**Corn**	Grain.

The crops in bold face are intended to be fed off on the field.

Wherever rape or clover occurs in these rotations care should be taken not to pasture too closely. Rape should be turned into when twelve to fourteen inches high and should not be pastured off too closely. Leaves are as essential to the health of a plant as lungs are to an animal; and, hence, there should always be present an amount sufficient to produce a maximum of growth. Clover may be turned into when five to eight inches high and should for the same reasons not be fed too closely.

The number of hogs that may run on each acre will vary, of course, with the abundance of the crop, and the amount of grain supplement that is supplied in addition. Usually, however, where corn is supplied to the extent of one-fourth of a full ration, rape and oats sown together will pasture from twelve to eighteen seventy-pound shoats per acre. Clover will generally support per acre two sows and their litters for the season, their litters averaging seven each.

In order to secure the greatest returns from forage the grain which is to serve as a supplement to it should not be fed in too great quantities. The general rule is to feed from one-fourth to one-half of a full ration. This will ordinarily be from one to two pounds of corn per hundred weight per day. If a pound of corn per hundred weight per day is insufficient to produce some gain with the forage fed, then increase the grain ration. A sufficient amount of feed should be supplied to produce about three-fourths of a pound per hundred weight per day increase.

MONTANA EXPERIMENT STATION. (1908)

Lot.	Rations fed.	Average weight of pig at beginning.	Average weight of pig at close.	Pounds of grain eaten.	Pounds of grain per lb. gain.	Pounds grain eaten per pig per day.
I	Full ration and Alfalfa	106	205	1,255	4.24	5.81
II	Half ration and Alfalfa	83	158	629	2.82	2.91
III	Full ration and in pen	110	223	1,347	3.96	6.23

From the data just given it will be seen that the hogs receiving a full feed of grain while on pasture required one and one-half times as much grain to produce a pound of gain as did the hogs that were receiving one-half grain ration on pasture.

The supplements to forages should depend upon the nature of the forage plant. Where the forage crop is a legume, such as alfalfa, clover, cowpeas or soybeans, corn will make a very satisfactory supplement; but where the forage consists of corn, sorghum or rye, better results will be obtained if the grain supplement is made about four parts corn and one part oilmeal.

In the light of the data that has already been worked out, it behooves us as meat producers to alter our methods and introduce more economical systems of pork production. The solution of economical pork production must come through the judicious use of forage crops.

SWINE FEEDING.

(W. S. Cotton, Smithton, Missouri.)

I am quite sure that I shall not be able to offer a single *new* idea in this matter of hog-feeding. I shall simply attempt to outline, in as concise a form as possible, my own methods, which are a combination of what I have been able to gather together from different sources, our own and other experiment station results, my neighbors and other friends, the agricultural press, and my own experience in adapting these different ideas to my own environment.

The problem of successful hog-feeding begins several generations back of the hog in the feed lot, but as it works in a circle, I will begin with my ideas of handling the sow.

My experience is that at no time, except while weaning the pigs, should the sow be confined to close quarters. If two litters of pigs are to be raised each year she will lead a pretty busy life, and will require a large amount of food to keep her in good thrifty condition, and while she shouldn't get too fat, it is usually the other trouble—*too thin.*

From two to six sows I find will get along very nicely together when they are raising their pigs; while dry, I keep more in one pasture, and feed two ears of corn each twice a day, and in the winter all the alfalfa hay they want—which is quite a good deal—and if I didn't have alfalfa I would try to have some choice clover.

I begin breeding my sows about the 10th of November, and try to get them all settled during that month, and the closer together the better. Then, when the pigs begin coming in the spring, I can make it my special business to take care of them at the critical time. If the weather is nice there is no trouble; the alfalfa has kept the sows in fine condition and their digestive organs expanded and ready to use a large amount of concentrated food. I begin giving them a little slop of good shorts a week before farrowing. After farrowing, leave off all feed for twenty-four to forty-eight hours, then feed lightly—about a quart of slop and increase gradually until when pigs are two weeks old the sow is getting about all she will eat with tankage added.

The pigs will begin to eat a little corn when about three weeks old. I provide this for them in a feeding place to themselves, and in another week or two begin giving them some slop, and as I increase this for the pigs, I reduce the sow's slop and increase her corn, until about the middle of May it's nothing but corn and time to wean and breed for fall litters.

I put the sows up in a dry lot and feed lightly for a while and the pigs don't know they are weaned. If there are any thin sows I separate them at this time and build them up. I breed only what sows I can catch to farrow in September, prefering to have all farrow in spring, even if some are a little late, and then run those over until the next November for only one litter a year.

I know that some of my friends think I feed pretty heavily, and contend that a slower method is more economical, but to raise two litters a year from a majority of your sows and average around eight pigs to the litter, you've got to *keep 'em goin'*, though you can't afford this intensive feeding with only three, four or five pigs to the litter.

Now, if you want to keep up to the hog limit of your farm, you've got to keep them going *after* weaning to get them out of the way of the next litters. To do this, my pigs get just about all the corn they want twice a day (cutting down the slop as clover comes) and half a pound of tankage to 200 pounds weight, with the best pasture I can give them—clover if possible—(and I hope some time to have alfalfa to use); if there is plenty of clover I cut down the tankage about half.

I continue in this way until within about thirty days of the time I expect to market. I then put the bunch into a lot and keep up the corn and tankage with plenty of fresh water and salt and ashes and, if cold weather, good bedding, and at this time I expect them to average pretty close to 2½ pounds a day gain, provided the lice are kept in check and they have been rid of worms.

Until two years ago I questioned the possibilities of profit in fall pigs. At that time I had sixty-five pigs of September farrow. On December 8th they averaged forty-seven pounds and were not looking as thrifty as I would have liked. I had not found satisfactory treatment for worms and concluded to try turpentine, which I did, giving a teaspoonful to eighty pounds weight in slop three days in succession on an empty stomach, and repeated in a week. This did the work, and I have since used it, shortly after weaning, and again when they weigh from 125 to 150 pounds.

I had been using *some* tankage for nearly two years, but not in a systematic way, so decided to try it on this bunch of pigs and keep an accurate record, weighing the pigs on Saturday of each week and keeping a record of corn and tankage fed.

Twenty of the choice pigs were sold for breeding; on April 30th I sold twenty head weighing 263 pounds; May 13th the remaining twenty-five head at 242 pounds. The last month the forty-five head put on an average of twenty-four pounds a day. They were all less than eight months old when sold. I now raise all the fall pigs I can. Under this treatment, my pigs are practically ready for market at any time, and at any time up to going into the lot for the last month's feed they have been handled in a manner to develop properly for breeding, and this is the time to select recruits for the sows' brigade, but hold onto the old ones until they show sure signs of deteriorating.

My entire herd are purebred Durocs and I do some business in breeding stock—(would like to do more)—but if I never sold a registered hog I would always mark my pigs so I could tell for my own benefit when finished what litters and families are doing me the most good from a purely pork standpoint, and to enable me to select my brood sows intelligently.

I consider one of the most important things in feeding hogs never to mix sizes in the same pasture or feed lot, and that is one advantage in having the pigs come at as nearly the same time as possible. I try to keep salt and ashes always where they can get them, and they have charcoal—but not always—and eat all the walnuts and acorns of course.

I have never fed any patent foods or remedies, but think tankage the greatest supplementary food we can get; it gives them a relish for their corn, and I think they drink a great deal more water when getting it, and water is, I think, a large part of fat.

Out of the bunch of sixty-five fall pigs of which I gave the history, I kept four gilts and fed to show at Sedalia and Kansas City a year ago in the under 12 Missouri class. They were never confined to less than twenty acres pasture, and when I left home for the fairs, weighed from 440 to 500 pounds, winning first as four best hogs get of one boar, and the 500 pound gilt being placed second in a class of 24 head at Kansas City.

I will say in conclusion, as proof of the efficacy of my methods, that I have at present in the feed lot seventy-five shoats averaging 220 pounds. These pigs are of average farrow of about May 15th, having sold my March and April pigs December 1st at 236 pounds weight.

THE TYPE OF HOGS THE PACKER DEMANDS.

(F. D. Winn, Randolph, Missouri.)

Not taking into consideration the offal, which is of secondary importance, the packer converts a hog carcass into two products, viz: Meat and lard. The best type of hog from a packer's standpoint is, therefore, the one that will cut out on the block the most valuable meat with the smallest per cent of cheap meat and offal, and at the same time furnish a good quantity of lard. During certain seasons of the year the packer looks more to the lard feature and demands hogs larger and fatter, while at other times he favors the lighter weights in the production of the best quality of bacon. This, however, has nothing to do with and does not affect the general type of hog that will for all purposes make him the most money.

The ideal hog from a packer's standpoint, as I see him—beginning at the front end, should have a medium short head with medium to small ear, jowl full but not heavy and baggy, as it furnishes cheap meat. One of the best type Poland China sows I have seen for some time, both from a breeder's and packer's standpoint, was turned down for championship last fall at three different fairs, and I think rightly so, because of an abnormal jowl. The neck should be short and full; shoulders set well in line with sides and rest of body with no tendency to shields or thick hide; chest should be full and well let down, with good width between front legs, and there should be no depression back of the shoulders, either on top or at the sides. The lower line of chest should make a perfectly straight line with lower line of belly and flank. The back should be slightly arched with rib well sprung, but not beyond the side line. A stick standing perpendicular and touching the edge of rib should also touch the belly line and side at every point. The loin must be thick and full and the meat covering loin and back should be of firm quality, but not hard: sides perfectly straight and deep with flank low and in line of belly. In my opinion, no point is more overlooked and is less considered by hog breeders than the flank. Without a low, deep flank you cannot have a deep side and middling, and you very seldom see a good flank without a correspondingly good side and ham. The two points most indicative of a quiet disposition, easy feeding, early maturing hog are head and flank. The rump should be almost level with long coupling and tail well set up in line of back. A short coupling is nearly always accompanied by a round rib, high flank and not enough body depth. The ham should be even with rib and side line and let down well to flank, but not out of line or proportion with rest of body. You very seldom find a big, bulging ham on a well proportioned hog, whose top and side lines are even and where the flank is properly let down. A very wide ham goes with a high flank and round rib which generally means not enough depth and width below. A baggy ham at bottom, often termed by breeders a "meal-sack" ham, is undesirable to the packer—all the lower, flabby meat being waste. The rather general opinion that you cannot get too much ham on a hog is very erroneous, if the statements of a number of experts connected with the packing business, with whom I have talked, are to be considered. This surplus ham had better be over the loin or filling and rounding up the very usual depression in front of hip bones and at coupling. Good length is desired—the distance from root of tail to center of forehead should be about the same as flank and heart measurement. The legs should set well out at the corners of body and be straight, tapering nicely to foot with short pastern joint and toes set close together. The bone can be heavy, if short, although a medium bone if of good quality—sufficient to carry a heavy body—would doubtless suit the packer just as well. A big coarse bone and long legs are very objectionable and hogs with such legs very seldom have the uniformity and quality to bring a top price. The coat should be smooth and soft to the touch, which usually indicates a thin hide and good quality of meat. Probably the most important point of all is the body surface, which must be perfectly smooth and free from wrinkles or creases. The flesh must be firm to the touch—soft, blubbery flesh that puts on unevenly being almost as undesirable as a thick, wrinkled hide. Evenness and smoothness are the things most desired by the packer.

While some of the other breeds have been in existence long enough, possibly, to have established one and a distinct type, it is not so with the Poland China which I handle and the only breed with which I am at all familiar. I think the last named breed could very consistently be said to furnish two distinct types, which some refer to as the round or "barrel" type and the "block" type. The former covers the broad backed, round ribbed, high flanked, wedge shaped kind while the latter is the flat sided, deeper bodied, lower flanked variety. Of these two types, Mr. J. J. Ferguson, head buyer for Swift & Co., and who judged all breeds of barrows at the St. Louis World's Fair, told me that the block type was more in favor and would cut out better on the block than the other type. To make this clearer, I have taken the measurements of the best boar that I have ever bred from a packer's standpoint. This boar has just turned a year and will weigh in only breeding and good growing condition approximately 350 pounds. His heart and flank measurements are the same—54 inches; length from root of tail to center of forehead, 53½ inches. His hind leg at smallest place measures 8 inches. He is 9 inches from lower point of ham and 11 inches from top of flank to ground. The distance across top between to sticks standing perpendicular and just touching point of ribs is 14 inches, while he is 19 inches in depth. For the sake of illustration, take a box 14 inches wide, 19 inches deep and 53½ inches long, round off the edges about half an inch and you have the shape of the best proportioned and most symmetrical boar I ever bred or owned. Before you can breed a certain type of hog, it is essential to have that type clearly fixed in your mind, and I would recommend that those desiring to become expert judges hunt until they find an animal of the type desired and then study that particular animal until the entire outline is indelibly impressed on his mind. Not until I saw the sow Darkness did I come to realize how distinct and clear cut an outline of a hog could be. This sow was more of an educator to me than information received from all other sources combined. I do not refer to this particular sow because I happened to own her, but to strengthen my argument in favor of the block type. Darkness was the best specimen of this type the Poland China breed has ever produced, and she is at the same time universally admitted to have been the greatest producing Poland China sow that ever lived; indeed her descendants have done more to improve the breed than any other six sows. Although quite exceeding the scope of my subject, while I am already off of it any way, I want to make the suggestion that the best way to improve the hog and arrive at, as near as possible, the packer's ideal is to look first to type and then improve any weak point or points. Many have hobbies, that is, no matter how perfect the type they will not keep for breeding purposes an animal with a bad ear, head, coat, feet or even color and markings. If I had followed that principle I would not have had the honor of breeding and showing the grand champion barrow at the St. Louis World's Fair. This barrow's grand dam, a half sister to Darkness, just referred to, and very much the same type, had a bad coat. I mated her with a fine-coated boar of some the same type, but not quite so pronounced, with the result that a part of the litter not only retained the type of the sow, but had a nice coat like the sire. I mated one of the sows from this litter with a boar especially good in coat and got this champion barrow of very much the same type as his grand dam and with as nice a coat as I ever saw. In the same manner any other defect may be remedied and the type preserved.

So much for the type of hogs the packer prefers. While my subject only covers the packers' demands, since this type is, in my opinion, so near the type that can be raised most economically, I take the liberty of discussing the subject briefly from the standpoint of the producer. The hog raiser will say—"all right for the kind of a hog that suits the packer best, but we're looking out for ourselves and want to raise the kind that net us the most money—give us bone, bone, bone." This great cry from farmers for bone was caused by a tendency of breeders several years ago to sacrifice too much bone and size for fancy points, such as head, ear, color, markings, etc. Because breeders went to extremes in the matter of fancy points and got hogs too small is no reason why the other extreme should be sought and size and bone looked after at the expense of quality, for one is as bad as the other. Breeders have come to realize that size and bone must be maintained, and they are striving to get just as much size and bone as it is possible to have and at the same time preserve the accepted type and quality that the packer demands and pays a premium for. The hogs that are receiving the awards at the best state fairs under the best judges we have are of a much larger type and bone than they were several years ago, and the improvement along these lines will continue. As I stated in treating the feet and legs of a packer's ideal hog, the packer does not discriminate against a heavy bone, if short and not rough. I know this not only from other sources, but from interviews with Mr. Ferguson, the packer expert who judged barrows at St. Louis. Pardon this personal reference, which is not made either to advertise myself or the breed in which I am interested, but only to illustrate and supplement my argument in favor of the smooth, large, medium hog as against the so-called "big bone" type. It was my good fortune to show the grand champion Poland China boar and the grand champion barrow, all breeds, at St. Louis. The barrow was, in the opinion of Mr. Ferguson, a perfect specimen of this breed with the exception of length, he being just a trifle shorter than the ideal type. This barrow was sixteen months old and weighed, not overdone at all, 500 pounds, having a heavy, short bone of the best quality and sufficient to carry at least 1,000 pounds weight. The grand champion boar weighed at a year and thirteen days old, 502 pounds, with a bone that must have measured at least 9 inches at smallest place. Without telling Mr. Ferguson that this boar had been made the Grand Champion Poland China boar, and he stated afterwards that he did not know it, he pronounced him an ideal hog from a packer's standpoint, not objecting in the least to his bone, which was very heavy for a hog of this age and size. He was stort legged and his bone was of good quality. I maintain that a hog of this type that can be made to weigh 500 pounds at 12½ months old, without being overdone, that has a short, heavy bone, but not rough, is the best size and type of hog from both the producer's and packer's standpoint. It is possible to get a heavy bone on a hog of this scale, but I claim that it is not possible, except in rare instances, and of course there are exceptions to all rules, to get the finish, the easy feeding, early maturing qualities, together with the accepted type, in these 1,000 pound monsters with bone as big and rough as a cow's. A hog that can be turned at from eight to ten months old, weighing 250 pounds and the type I have favored can be made to do this, is large enough and I believe that the less amount of feed consumed by this type will at least offset the extra weight of the bone and hide of the big ones and that the producer will be ahead at least the difference in price per hundred his smooth, nicely finished hogs bring over the necessarily rougher type of the extra large ones. The packer is certain to pay a premium for the kind that nets him the most money, and this type I have in my plain way tried to describe to you.

COTE SYSTEM VS. CENTRALIZED HOG HOUSE SYSTEM.

(June K. King, Marshall, Missouri.)

That hogs, more than any other of our breeds of live stock, need shelter is certainly true, and that they get less housing than perhaps any of our live stock is also true. You hear frequently expressions like these: "Most anything is good enough for a hog;" "Hogs do not need shelter;" "Corn is a mighty good cross for a hog;" "It costs a heap to care for hogs like you do," etc.

I believe that for most farmers the centralized hog house is perhaps the most convenient. It should be well located on a high, dry place, arranged in such a manner that the sun can shine into all parts at least a part of the time, with water and feed convenient; the pastures should be near; the lots or pens should be as roomy as circumstances will permit and open into the pastures; the lots or pens should be concreted or paved.

I have in mind a neighbor who is making quite a success raising hogs for the market. He raises about 200 each twelve months. He has two houses that will accommodate about ten sows each, with a shed or alley-way to feed the pigs in in bad weather. There is also a corn crib at each house. As yet he has not water convenient, nor small lots, but his pastures—some eight or ten, each containing from ten to twenty acres—are so arranged that he can utilize any one with one or the other of his houses.

Feeding floors are very essential to the well-being of the hog, and can be built at a reasonable cost for material; the labor can be performed by the farmer and his hired hand.

The greatest objection, I think, to the centralized hog house is disease. Should you have an outbreak of some contagious disease you cannot so well isolate your hogs nor can you so readily disinfect. If one has the means, I would advise combining the two systems—having one or more larger houses and then as many cotes and their adjoining lots as you need.

In this section we often have a severe snow storm—which lasts only for a short time—that makes proper caring for hogs out of doors almost impossible. At such times it would be convenient to have a larger hog house where all the hogs could be brought in from the small houses and cared for with great comfort to both the herdsman and the hogs. The larger hog house should be built with an alley way running the whole length of the building with stalls or pens on each side. These pens should be not less than 8x10 feet—the larger the better. The alley way could be used to feed in. With a supply of straw for bedding, with alfalfa and clover hay in the loft, and water and grain handy, the larger house would soon pay for itself, and then when the storm was over the hogs could be taken back to their cotes and lots. This is not what we have at Peabody Farm, but what we hope in the near future to have.

BREEDING OF HOGS FOR MARKET PURPOSES.

(C. B. Adams, Grandview, Missouri.)

Every systematic breeder and up-to-date farmer realizes that the ultimate end of hog-raising is the pork barrel, and the quicker the growth to market maturity the more profit there is for the husbandman. There are two very important factors for the swine grower to consider: First, the breeding of a type that has the power of applying food to the laying on of muscle and fat and will provide a maximum amount of choice pork at a minimum cost; second, the feeding of the proper kinds and amount of food to get the desired results—one is as essential as the other. The details of breeding hogs and caring for hogs are so intricately interwoven that one may select an excellent foundation for his herd, but, if he does not feed and care for them properly the work is usually ineffectual. On the other hand it would be equally as disastrous to feed and care properly for a herd that had been poorly selected. As this last point is to be discussed separately, I shall deal directly with the breeding of the type most profitable to the farmer.

A subdivision of a family in the animal kingdom may be recognized as a distinct or separate breed when with very slight variations it will reproduce under the same conditions until it has acquired a distinctive character common to all the members. In every family of domesticated animals there are numerous variations continually cropping out. Through man's interference and control of these variations there are in all hogdom several recognized breeds of hogs, but all may be satisfactorily placed in one or the other of the two great classes: viz, the bacon hog and the lard hog. Each has a distinct purpose to perform, brought about by breeding and artificial conditions, together with the natural cause—the different kinds of food found in different sections of the country. England may admonish us upon the quality of our bacon, Denmark may beat us to the market, but at present and for years to come in the seven corn producing states the prevailing type is and will be the large, early-maturing lard hog.

As to the breed you advocate, that is your pleasure, for there are more differences in the individuals of any one breed than there are in the characteristics of the different breeds.

I am persuaded to look upon this as a convention of progressive, up-to-date farmers and stock-growers. There is a kind of dignity about this that elevates one to a plane above the common farmer citizen. It requires a great deal of enterprise to understand and realize that pure bred animals have a decided advantage over common grades or scrubs, and that money expended in purchasing a few high class animals will ultimately bring reward. You are after the profit, are you not? Then the type that feeds well and makes the maximum of pounds, that will sell at a good or top price, is a pretty good ideal for every swine grower. The old-fashioned, coarse, slow maturing hog is a thing of the past. They were prolific and hardy, but would not fatten readily until well on to maturity, thus making the process of producing pork cost more per pound than is the case with the improved type.

The fancy, fine-boned, dumpy type is not proving entirely satisfactory. It is claimed that they are not prolific and not good enough mothers. My experience has led me to believe that this is generally true. There is some demand for nice, well-finished pigs of 90 to 100 pounds weight at about 5 months of age, but it is very evident that the demand and price is not so great as to entice many of our swine growers.

The best type of general purpose or market hog is the one that is being evolved by the swine growers of the corn belt, and by some is designated the medium type, and by others as the large smooth type, which means practically the same. These hogs will mature at from 600 to 700 pounds, and with proper care will weigh 250 pounds at 7 months and about 300 pounds at the age of 9 months.

The pure bred breeder caters to the farmer, the farmer depends upon the packer and the packer pays the best averaged prices for young hogs finished in prime condition weighing about 250 to 300 pounds.

The packer is demanding quality, the farmer is seeking prolificacy and size combined with easy feeding qualities; and if you will study the characteristics of all the lard hog breeds, it is evident that the pure bred breeder is striving to supply these demands.

In selecting the foundation for the breeding stock, I would choose the sow that conforms as nearly as possible to the ideal type. The face should be slightly dished and clean-cut, nose of medium length and not too wide, forehead broad between eyes, jowl plump and smooth but not flabby, neck short, deep and of medium thickness, shoulders smooth and deep and should be of the same thickness as the back and ham. The back should be broad and slightly arched to give strength, but of medium rather than great length, chest broad and deep, flank full and let well down. The ham, for which this type is noted, should be full, symmetrical, long and rounding down to the hock, legs of medium length with plenty and quality of bone, standing well on the feet.

The sow must be decidedly feminine in appearance, possessing neatness, symmetry and style. She should be of a kind and quiet disposition, an easy feeder, and prove to be prolific and prepotent.

The boar should be of the same type as the sow. We should never expect a satisfactory result by crossing two extremes. He should be large, strong, massive and possessed with stamina and constitutional vigor. With his size must be combined smoothness, symmetry and finish; his expression must be one of intelligence and kind disposition. The ideal boar is decidedly masculine in appearance, stately in carriage, and stylish in action.

The description I have given is my ideal type of the money-making porker; while very seldom will you find an individual that embodies all these qualities; yet in all breeds you will find many that come closely to the standard. Pick out your breeding stock, the best you can afford, and always strive to improve and perpetuate with a little better individuals of the same type and of the same breed.

It is a rule among the best pure bred breeders to select the best of the male progeny to develop and perpetuate type, but my advice to you is that you retain the female progeny that conforms the closest to the ideal type; as you are then certain about the qualities and prepotencies of more individuals, and chance purchasing a male of the desired type and breeding. Theoretically, the prepotency in both sexes is uniform.

It is unsafe to try innovations by cross-breeding owing to the persistent tendency of ancestral types cropping out.

Perpetuate your type. It is the similarity of the herd that stamps the skillful, progressive, swine-grower and brings the largest returns.

SIXTY CENT CORN AND FIVE CENT HOGS.

(Chester Starr, Centralia, Missouri.)

When Mr. Willson requested me to appear before this convention, he suggested as title "Sixty Cent Corn and Five Cent Hogs." Feeding the sixty cent corn alone, I couldn't figure out much profit on that basis, but fortunately the corn market has weakened and the packers have not made good their boast of five cent hogs. By aid of these two factors, the feeder may still make his work pay. During the recent years, we have seen corn rather uniformly high; fortunately save for several months in 1907 and 1908, we have received high prices for our animated pork barrels. All of us remember the times when corn was sold for from fifteen to twenty cents. Hogs were also low. Personally we have had better success with the high prices. Still we must figure more closely than we used to. We must pay closer attention to details and make more use of our experiment stations—the people own the stations, why shouldn't we use them. Their results are very often highly important to us.

Our hogs are almost wholly fed after cattle. I am more at home in that phase and with your permission I will confine myself to that line. For several reasons we have no accurate figures of what our hogs do and what they cost us. We buy stockers at all times and, when shipping, select a car load or two, weighing the selected ones only. Our hogs are usually fed more or less, the amount of extra feed depending on their appetite. Feeding in this manner, it would require a large amount of time and labor to keep track of their gains and cost of gains—the results would not pay for the extra work. We depend largely on our eye as to the condition.

Of course, the number of hogs following cattle vary, depending upon market, age of cattle, size and condition of hogs and the ration of the cattle. In times when stockers were low we have had as high as five to a steer, usually we use two to our two year old cattle, fed on ear corn or fodder. The more range the hogs have, the better will remain the health. We keep our hogs just a little hungry and consequently they trail the cattle all over the pasture, getting the extra feed found and, in summer, getting fresher grass. In winter, we use a barn, rather a shed as it is open on the south and has two twelve foot doors on the east and west. Naturaly the cattle wander very little and if left alone, the hogs would travel still less. The barn is sixty rods from the cribs, and every morning just as the feeder drives out into the pasture, he calls the hogs up to him to be fed. That stone kills two birds. The hogs must walk, at least, 120 rods, and before they get back to the barn, to bother by diving in under the wagon, the feeder is through putting out the feed. Our watering troughs are arranged to let the hogs have plenty of pure water, but not muddy the cattle water. We use more or less medicine—not stock food—buying it in barrel lots and doing our own mixing. The mixture is three parts of Sal Soda, of Glauber's Salts, of Copperas and one part of Sulphur. The principal effects are laxativeness and extermination of worms. In winter, we keep it out before the hogs at all times, putting out fresh quantities three or four times a week. In summer once a week suffices. Our hogs vary in size and weight. In buying, we like big framed lean hogs; the range of weight is from 90 to 175 pounds. Fat chunks and slop fed hogs never do very well following cattle. We ship whenever we can select a load weighing from 225 to 300, the weight depending largely on the market. Our gains, as closely as we can determine, average around a pound and three quarters daily, the rapidity of gain depending on age and condition of hogs and amount of feed they receive. According to the Purdue Station, Indiana feeders report an average of 1.4 pounds and the Missouri Station reports 2 pounds. The Ohio Station has gains from .92 to 1.71 pounds, the hog not receiving any extra feed.

Recently we have been interested in two experiments which are reported by the Purdue Station and the Ohio Station. The results of the experiments show striking value for protein feeds. One when fed to cattle and the other when fed directly to the hogs. I take the liberty of borrowing some of their figures and present them. The Purdue Bulletin is numbered, I believe, 115. Thirty-three cattle were divided into three lots. Lot 1 received corn and clover; lot 2, corn, oil meal, *stover* and oat straw; lot 3, corn, *stover* and oat straw. Prof. Cochel says that no extra feed was fed to the hogs. The hogs following lot 1 cattle, gained 1,048 pounds in 180 days. Lot 2 hogs gained 996; lot 3 hogs 888; quite a difference in favor of hogs following the corn and clover hay lot. The author also calculated the pork per bushel of corn fed to the cattle. Lot 1, hogs made 2.1 pounds per bushel of corn; lot 2 hogs 1.8 pounds; lot 3, 1.78 lbs. The lot 3 hogs were always unthrifty, the big framed lean hogs doing better than the smaller ones. That probably can be explained in the different food needs of the two classes of hogs. The thing especially interesting to me is the difference in favor of clover hay over both the other rations. The nutritive ratio of the rations of lots 1 and two are 1:10.7 and 1:10.4. Why did the hogs do better after the clover hay fed cattle? In other words, does protein feed as roughage do the following hog more good than feed as a concentrate? If this is true, we have an additional reason for growing our own protein feeds in the shape of clover, alfalfa and cow peas. It might be that more of the nitrogenous part of the clover escaped the cattle's digestion and might be used by the hog and the lot 1 cattle did better than lot 2. I would like to hear ideas on that subject. If true, it is a valuable point to the feeder.

The Ohio Station fed tankage to hogs following cattle; each lot had seven steers; lots 1 and 3 received corn, cotton seed meal, *stover*, mixed hay and silage; lots 4 and 6 received the same ration except silage. The hogs in lots 1 and 6 received 1-3 of a pound of tankage daily per head, in addition to what they could glean. The first 60 days, three hogs were in each lot, the last 56 days, four smaller hogs replaced the first set. The gain of the hogs receiving tankage was 1,230 pounds, the gain of the hogs not receiving tankage was 808—a difference of 422 pounds. The total amount of tankage fed was 259.5 pounds; that would cost at $45.00 a ton, $5.85. The extra pork, 422 pounds at 6 cents would be $25.32. How is that for profit?

We are using meat meal this winter. Just now we have 160 hogs after our cattle, they are getting 50 pounds of meat meal daily. They would eat a ton if in a place where they could get at it. They act very much as a lot of boys do towards a neighboring unguarded watermelon patch. Our feeder, says that the hogs do not seem to care for the medicinal mixture as much as in former years. The Ohio Station observed that their hogs receiving tankage did not care for salt and ashes. The tankage seems to fill their want for something besides corn.

DISCUSSION BY C. M. LONG.

The question of making 5 cent pork with 60 cent corn is a very vital question with all practical farmers. In other words, it is about the same question as what shall we do with out high-priced corn? We have been taught that the hog is about the cheapest meat producer, and if we can not feed 60 cent corn to him what can we feed it to? It is a question that is foremost in almost every mind. Then, there is a general practice of feeding straight corn, but most of the results show that it is a losing game. It takes about 500 pounds of corn to make 100 pounds of gain. When corn is worth 60 cents, or more than one cent a pound, we are certainly losing out. Most of us are helping to solve this question by holding our hogs and our corn until hogs become higher.

The Iowa Experiment Station has been able to make pork from corn only as low as $4.82; I don't know how they do it. In Oklahoma, $8.00 was the cheapest we could make it. With meatmeal and good tankage, Iowa has produced pork at $4.11, a rather small margin. In Oklahoma, by using cowpea hay at $6.00 and corn at 60 cents, we were able to make gains almost as cheaply as with just tankage and corn. Tankage costs $35 per ton, and that is a point which it seems to me to be of interest to practical men, and the same is true also of soy beans. If we can use soy beans and cowpeas and get almost as good returns as from packing-house products, we ought to do it.

Here is another point: Mr. Ellis reports in the year book of 1903, an experiment that shows that they made pork for $2.44 when they used skim-milk. I wonder if that would not be a solution to this problem—to feed with skim-milk.

DISCUSSION.

Q. How much corn do you feed to a steer to make the gain you speak of on the hogs following?

Mr. Starr: That varies. Of course, as I said, we feed more or less corn to hogs. It depends on environment. If we have cattle on full feed of corn, it will not take as much extra corn for the hogs. We never practice full feeding except in the winter time. We don't full feed in the summer time. We feed about 14 pounds of shelled corn during the winter to the steer, and two hogs eat after that.

Q. What style of trough do you have?

Mr. Starr: Just the ordinary trough.

Q. Are you very particular in regard to the type of hog you buy?

A. We are not particular in regard to the type, except that we like lean hogs if we can get them; and of course, we consider whether they are healthy or not.

Q. That medicine—salsoda, copperas and Glauber's salt—do you feed it on the ground?

A. We have troughs to put it in. It has to be pulverized.

especially the copperas, and after it is pulverized we put it out in small troughs.

Q. How do you prevent waste by rains and snows?

A. Well, we lose some by rain, but in the winter time we keep it inside the barn where we feed the cattle. Some of the time it is out in the open, but it only costs about one cent a pound, and we like to keep it fresh and put out only a little at a time.

Q. What does this medicine cost you?

A. Salsoda and Glauber's salt, laid down at railroad station, cost about 95 cents a hundred; sulphur 10 cents more a hundred—amounts to about one cent a pound.

Q. Will you state the formula again?

A. Three pounds each of salsoda, Glauber's salt, and copperas and one pound of sulphur.

Q. Do you ever use charcoal?

A. No. It would be quite a job to get and burn corn-cobs, and I think this answers the purpose.

Q. Do you think charcoal would be of any advantage?

A. It might be. But we use this formula to keep the hogs laxative.

Q. State the amount of tankage you feed?

A. Thirty pounds per day.

Missouri Sheep Breeders' Session

Tuesday, January 5, 1909.

THE DOMESTIC SHEEP IN AMERICA.

(Professor F. B. Mumford, Missouri Agricultural College.)

We scarcely realize, at the present time, the place the domestic animals have occupied in the advance of man toward civilization. It is scarcely possible for us to conceive where the human race might have been today if they had been compelled to have worked out their civilization altogether unaided by domestic animals. We can easily understand how, in ancient times, people were strong or weak and progressed in civilization in proportion to their ability to fight. We can readily understand how, for example, the horse at one time came to be the great factor in determining which people should rule. In the first place, horses were used not for hauling wagons and carts, but were utilized solely for war purposes, and the people that first developed an efficient cavalry were bound to rule. In the advance of man in civilization, the domestic sheep has been one of the most important of our domestic animals. They have not contributed to the war-like progress of people, nor have they contributed in the past nor do they now contribute to the savage instincts of man. Nevertheless the humble sheep has supplied clothing and flesh for unnumbered generations to civilized peoples.

The domestication of sheep is of great antiquity. We find sheep first mentioned in connection with the farming operations of Cain and Abel. Cain was a grain farmer and Abel a sheep farmer; and we are told that Abel was justified in the sight of his God, and the sheepmen have ever since enjoyed the protection of Divine Providence.

In our own country, domestic animals have played a particularly important part. There has never been in the history of the world so rapid a development of agricultural resources as that which has taken place in North America. Civilization has swept across the United States in an astonishingly short period of time, and we have today here in the middle west an advanced civilization with stable governments and social institutions that compare favorably with those in countries where civilization has been advancing and progressing for many generations. Now, I am prepared to say that if it had not been for the help of the domestic animals in crossing the plains and uninhabited areas of this country, and in utilizing the products of the land, this could not have been accomplished. The domestic animal has been a condensing machine; he has not only been a condensing machine, but he has been the only means of transportation in the early pioneer days. The beef steer was not only able to fatten himself, but he was able to carry the manufactured product to the market, and it was impossible, in the absence of transportation facilities, for men to develop the country by the production of grain or hay, and we shall always in this country depend upon the domestic animals to market the larger part of our products. And the middle west farmers will always find it necessary to make a large use of domestic animals. It has been demonstrated that under present conditions and present prices of farm products, the only salvation of the American farmer located in the middle west is a large production of high class animals.

Now, the history of the domestic sheep in America is one of great interest to every student of breeding problems. Our attention has often been called to the tremendous development which has taken place in machinery during the nineteenth and the beginning of the twentieth century. Our attention is called to the locomotive, the telegraph, the telephone, the steam-boat and other marvelous inventions that have revolutionized our social life, and we are sometimes wont to think that the farmer and the breeder have been behind in this great development; but while these inventions have been taking place the farmers have not been idle, and we have in the American Merino sheep in this country one of the most marvelous examples of the influence of man on the development of characters useful to civilized people that has been seen any where else in the world.

In 1850, the average fleece on the sheep of this country was 2.4 pounds. In 1900, the average fleece of sheep in the United States was 6.9 pounds per head. In other words, in the short space of 50 years, the producing power of a sheep, measured by the wool yielded, had increased nearly three times in weight; and it was the *average* farmer who had produced these results, the farmer who pays no attention to improvement. If we take those examples which apply to the men who have actually and intelligently engaged in improving the Merino sheep, we find that in the beginning, around 1800 to 1810, there were thousands of Merino sheep imported into this country that sheared an average of 3½ to 4 pounds of wool per head. Now, on that foundation, the breeders of this country undertook to produce a sheep that would yield a large fleece of fine wool of excellent quality. In a very few years, sheep were produced that averaged 10 pounds of wool, and we have a record of a single sheep that producd in those early years (1830-35) as much as 25 pounds, and this fleece was gradually increased to 30 and 35 pounds, and finally a single individual was produced that sheared 44 pounds and 9 ounces of wool. There have been reports of sheep that have produced over 50 pounds of wool; but this 44 pounds record is authentic and is stamped with the approval of the official registry book of the association. The Vermont Merino register gives the average weight of fleece of 36 rams as 31 pounds; 54 ewes averaged 19.11 pounds.

The beginning of the sheep industry in this country is to be found around the date 1800, and in considering the development of the sheep business in this country, we look first to the American Merino, because this country became famous for its Merino sheep. These sheep were imported from Spain. The first sheep, so far as I know, were imported in 1793 by William Foster who presented a ram and two ewes to a friend of his, and this friend, not realizing the value of these particular individuals, had them killed and ate them. I regret to say that this same man later had to pay one thousand dollars for a ram not so good as the one he killed and ate. A few years after this, in 1801, we have the next record of an importation of sheep into this country, and in that year Seth Adams of Massachusetts imported a few sheep. In 1807, Anderson of Ohio took some sheep into Ohio, which were the first introduced into that state. In 1802, Humphreys, who was afterward to become famous in Merino sheep history, imported one ram and 17 ewes from Spain. For a long time, the government of Spain placed an embargo on the exportation of sheep from that country which made it very difficult to secure sheep for this country; but small numbers of sheep were sent out by Col. Humphreys and Mr. M. Jarvis, then consuls of the United States; these men were able to secure some modifications of the government rules whereby the United States was able to secure some of these sheep, so that in 1809-10 thousands of sheep were imported into this country by these gentlemen. It is believed that during the years 1810-11 as many as 20,000 sheep were imported into this country from Spain. In 1810, this country enjoyed a sheep boom, and people went wild about Merino sheep. They paid $1,000 and $1,500 for Merino sheep that were afterwards sold for a mere song. This boom was disastrous in many ways, but one thing resulting from it was that the Merino sheep were widely advertised and everybody wanted to buy sheep. In these early years, Merino sheep were handled in the eastern part of the United States, and I only need to mention a few of the names of great men who were famous for the breeding of Merino sheep: Atwood of Connecticut, Hammond, Jarvis, Stickney and Rich of Vermont, and Dickinson of Ohio.

In the days of the development of the American Merino sheep, the agriculture of New England was in a prosperous condition. The decline of sheep husbandry in the New England states has been coextensive with the decline of agriculture in New England. Now, I am not in a position to demonstrate to you that the decline of sheep husbandry in New England is the cause of the decline of agriculture in New England, but it is a significant fact, at least, that as in the days of the zenith of Spain's power the Merino sheep industry was her greatest asset, so it is also significant that the rise of the sheep industry was co-extensive with prosperity in New England's agriculture.

However, the American Merino sheep declined. The early breeders of Merino sheep conceived the idea that the best sheep was one that could shear the largest possible amount of wool to the carcass. The unconscious result of this kind of breeding diminished the size of the sheep. Sheep that weighed 85 or 90 pounds sheared 30 and 35 per cent of their live weight in wool. That practice was one which resulted in injuring the constitution of the sheep, and in practically destroying their usefulness for any purpose but the production of wool, and even for that they were not successful, because they were reduced in constitution and in size.

Merino sheep have long been known to herd better in large flocks than most other breeds. This is undoubtedly due to the methods of handling practiced by the old Spanish shepherds. The Transhumantes Merinos were the traveling flocks of Spain, and these great flocks traveled long distances from one part of the country to another. In some places walls were built enclosing a wide roadway through which the flocks were driven. This practice must have resulted in a kind of selection which destroyed the weaker individuals and has given us the hardy Merino.

In recent years, and particularly during the development of the middle west country, there has been a remarkable increase in the number of mutton sheep. This has been due to several causes, but we can not stop to consider them at this time.

The first mutton sheep, the Southdowns, were introduced into New York in 1803. The first importation of Shropshires was in 1860 into Maryland—only a short time ago, as you will observe. In 1861, '62 and '68 importations were made into New York, and in 1875 Shropshire sheep were imported into Michigan, and in 1888 into Illinois. Just a short time ago, then, Shropshire sheep were unknown in this country, and yet at the present time the Shropshire breed of sheep registers more animals than any other live stock registry association in the world. The development in Shropshire sheep has been very remarkable in this country. Along during the '80s, a good many Shropshires were imported into the middle west.

The Leicesters, Cotswolds and Lincoln sheep, heavy breeds of mutton sheep, have never been very popular in the United States; they have been more popular in Canada and in England than in this country.

So much for the history of the domestic sheep in America.

The relation of the domestic sheep to our systems of farm management is a question that is particularly interesting to those of you who are managing farms, and is a question which is worthy of some attention. The question is often discussed as to whether in this country farms are becoming larger or smaller, and the statistics do not throw much light on the subject. We are told by some that farms are certainly growing larger. We are told by others that farms are certainly becoming smaller. In my opinion, what observation I have been able to make, I think that we are passing through an era in which farms are growing both larger and smaller, if you can conceive of such a paradoxical condition. What I have in mind is that there are being developed extremes more than heretofore, the *average* size farm is and has been for the past twenty years passing away, in numbers at least. We have more large farms and more small farms than we have ever had before.

Now in the past, cattle have unquestionably been the means by which we could best transport and convey the rough materials which have been produced on the farms of the west. As farms become smaller and our methods of farming more intensive, it will be necessary for us to secure much higher prices for meat products or greatly reduce the cost of production. Sheep are economical producers. A pound of mutton may be produced for about one-half the cost of producing a like amount of beef under similar conditions. The sheep yields two crops a year—wool and the lambs. Under many systems of extensive sheep husbandry the wool pays the annual cost of feeding the ewe and the lamb is profit. Sheep may be profitably handled on small farms intensively managed.

One other thing to which I would call your attention is, that there has been a most remarkable decline in the numbers of sheep in the world in the last ten or fifteen years. There has been a reduction in ten years in certain European countries from 164 millions to 121 millions—a loss of 25 per cent in the number of sheep. In this country we have had an increased production of all of our domestic animals; but sheep have increased more slowly than any other animal on the farm.

The demand for sheep and their products is greater today than ever before. The consumption of mutton is greater and constantly increasing. The demand for wools is likewise increasing. These facts, taken in connection with the great decrease in numbers of sheep in Europe and a relatively slow increase in America seem to point to the fact that the outlook for sheep husbandry is very promising, and will undoubtedly continue to be a most profitable industry in this country for many years to come.

WOOL STORAGE AND MARKETING.

(J. A. Delfelder, Representative National Wool Growers' Association, Walton, Wyo.)

The present methods of transacting business in any particular channel of trade or industry are, in a greater or lesser degree, accidental, and our present method of handling the wool clip is no exception to this general and well defined rule.

As the fortunes of an individual are varied by accident, energy and determination, so the methods of a great commercial business are variously developed, in their growth and inception, by their environments.

It has practically been due to necessity, for instance, that the cotton and tobacco growers are selling their own goods and manipulating their own finances, while the wool producer must sell to a speculator without competition or place his clip in the hands of an eastern commission merchant who manages his finances for him and receives compensation for numerous forms of services which are not necessary, and have a depreciating effect upon the profits of the business.

The financing of pork, corn, wheat, cotton, and all staple and kindred commodities of the United States, excepting wool, is performed through loans in which these products are freely accepted as collateral, but wool, for no founded reason, is regarded with distrust to such an extent that it has been discredited as collateral, so that many banking institutions have said that they would prefer the unsecured notes of a merchant to a note secured by wool as collateral.

The continuance of this unjust impression of wool credits is created, first, because it is taken for granted that the loan is expressly intended for the benefit of the speculator; and second, because many of the banking institutions are laboring under the false impression that no clip of wool can be described with sufficient exactness to make it a desirable security for a collateral loan.

It must be conceded by all well informed wool men, that the character and quality of wool are so changed by climatic conditions and potent influences, that even when uniformity of grade and staple are secured, actual value may be either enhanced or diminished by shrinkage.

The objectionable features are overcome by our storage house movement. When a clip of wool arrives, should a grower so elect, it will be graded by an expert grader, and resacked, and when the certificate is offered for collateral, it will bear evidence of the exact number of pounds, grade and condition represented in the clip. By consulting daily quotations, the banker can readily ascertain the value of the wool.

The growers of live stock and grain can secure immediate cash and value for their product by taking it to the nearest shipping point, but the wool grower is not even able to ascertain the value of the product within a reasonable distance from his shipping point, because the few buyers and solicitors who are present are not always inclined to play fair, and base their offers on the dormant and ill-regulated condition of the market.

In every branch of trade and industry there is an active and inactive period, or in other words, there is a slump period some time during the year, and the handling and manufacture of wool is no exception to this well founded regulation. This period, known to the woolen manufacturers as the "cleaning season," is during the spring and early summer, and during this inactive period the manufacturer reduces his force, works up odds and ends, repairs and overhauls his equipment, solicits orders, and is not in the market for supplies. On the other hand, the dealer has invariably disposed of his desirable stock, and if he has wools on hand they are of an inferior grade and are offered for sale at greatly reduced prices. It is during this same period that wool is being shorn in the western states.

The wool grower of the past finds himself in a very perplexing position; without an open market for his product and with no available storing facilities at his command to protect his clip from the weather, and a pressing need for funds with which to pay his employes, grow his crops and conduct his business. They have in numerous instances disposed of their clips at prices ranging from ten to twenty-five per cent below the market value.

The storage house will entirely eliminate these unsatisfactory conditions.

With the present methods there is entirely too much waste and carelessness in the handling of our clips. In the first place much wool is shorn in a very reckless manner, the shearers' entire endeavor being to fleece as many sheep as possible. They haggle the wool and leave from one to two pounds on the sheep's back, thereby unconsciously depreciating the value of the fleece. In the second place, the wool is collected, tied in bundles and placed in bags regardless of grade, texture or general character. A little attention to this particular feature of our industry would have a tendency to increase the value of our fleeces.

Another matter worthy of attention is the unnecessary handling of our clips before they reach the manufacturer. Large quantities of hides are shipped directly from the packing houses to the tanneries, and hundreds of thousands of bales of cotton go directly from the grower to the mills without delay or trans-shipment, but wool is not only handled and rehandled and directed many times from its destination, but is carted and hauled across the seaboard towns in a most uneconomical and unbusinesslike manner. Cattle, sheep and horses are delivered at the stockyards; grain, cotton and other kindred commodities at a storehouse. In

Boston and other wool centers, wool is received far remote, and is carted and hauled through the streets to the merchants' storehouses. Here it is moved about, handled, hoisted and sold, and then carted back on its way to the mills. If the wool is largely sold through our warehouses with connecting tracks from all railroads, the wool will be received and reshipped without rehauling.

Another important feature of our proposed warehouse proposition is that our clips will be concentrated and offered for sale collectively, instead of being scattered in a thousand different places all over the inter-mountain region. This will enable the merchant and manufacturers to dispense with the bevy of solicitors who go out each year to the farm and ranch and purchase and solicit consignments in small lots. Just what it costs to support this method I am not in a position to state, but judging from all outward appearances, I feel safe in estimating that it is not less than one hundred thousand dollars per year. Who will be directly benefited by this great saving I cannot say, but I have reasons to believe that a small portion would eventually revert to the industry.

By selling our clips through our own agency the result is advantageous to the merchant and manufacturer, as it enables them to eliminate many expenses and to purchase uniform lines as are usually required to meet their demands, and it affords us the pleasure of dealing directly with the merchants instead of a bevy of subordinates.

The plan proposed is in accord with the progressive business methods of the twentieth century and commends itself to the eastern financiers, and we have the assurance that abundant capital can be secured for this purpose if needed.

Combinations are arising among merchants and manufacturers, and if they combine while we are divided, the producer of wool will have all the disadvantages which come from ruinous competition among themselves, arranged against concentration among the purchasers of their product.

Another matter worthy of consideration is that we must endeavor to produce the kind of wool that the market demands.

The individual sheepman who sells his clip to a local buyer or sends it to the eastern commission house, has no opportunity of knowing how far his clip corresponds with the requirements of the manufacturer, or what changes should be made in the method of breeding or handling the wool.

That there should be an improvement in our present method of handling our wool, no well informed and progressive producer will deny. Industrial life in all its channels is throbbing with the instinct of progressiveness.

A great noticeable and effective improvement has been made in the handling of live stock, grain and cotton and kindred commodities, bringing them to a basis that is in accord with the business methods of the present century, while wool, and wool alone, the most important commodity of the great west, a leading staple and one which requires the utmost care, exactness and technical knowledge in handling, has drifted along in the same old rut without change from methods inaugurated through necessity and accident, tied down by tradition and usages which it is hard to overcome, and never will be if left to the dealers for revision, or in other words, wool is the only leading commodity that has been denied the benefits and privileges of an open market.

It is a well established fact that any method for the improvement of our condition must be worked out by the growers, and this can be done only in co-operation on a scale large and strong enough to wield a potent influence. It must be of such a nature that no doubt can be raised as to its purpose and permanency. That the producers can handle and dispose of their clips through an agency established and operated by themselves is no longer an experiment. Last spring, at the beginning of the shearing season, the growers of Wyoming were visited by the usual bevy of eastern buyers and solicitors. They confronted the grower with their usual hard luck story, of the great losses their houses had sustained the previous season, the stringency of the money market, the demoralized condition of the wool market, the dread of tariff revision, and an enormous amount of surplus wool on hand. They rarely offered to buy, and when they did make an offer, it ranged from eight to twelve cents per pound, thereby thinking to force the producer to consign his wool at an advance of eight cents per pound.

The executive staff of The Wyoming Wool Growers Association had foreseen the situation, and in anticipation of this attitude of the solicitors, had arranged during the early part of the year with Omaha banking institutions to accept warehouse certificates as collateral, with the railroad to grant a sale-in-transit rate, and with the Omaha Commercial club to erect a warehouse. The house opened for business about June first, and without any apparent change in conditions on the range the buyers advanced their offers about three per cents per pound, or in other words, this avenue of escape, opened by the Omaha warehouse, apparently enhanced the value of the Wyoming clip of thirty-seven million pounds, over one million dollars. The growers who stored their clip in the Omaha house borrowed eight cents per pound and pledged their warehouse certificates as collateral, and have carried their wools for a period of six months, interest on loans included, for less than one-half cent per pound. The clips that have been sold through this house have brought the grower from three to five cents per pound more than was offered when wool was shipped, and the wool still on hand will net the grower a much greater advance.

The western wool growers generally, and the executive committee of the National Wool Growers' Association in particular, seeing the benefits to be derived, the prestige and importance of the wool storage proposition, have arranged to erect and operate large houses at both Omaha and Chicago, and on behalf of the National Wool Growers' Association, I extend to you a hearty welcome and earnestly appeal to you to affiliate with us in this great enterprise for the betterment of our condition.

THE VALUE OF UNITED EFFORTS AMONG SHEEPMEN.

(Mr. Howard A. Chandler Charitan, Iowa.)

It affords me great pleasure to be with you this morning, and especially to talk on the sheep subject, because I believe that this State will be one of the greatest ones for sheep in a very short time.

I consider that one of the most important subjects before us at this time is that of the value of united efforts among sheep men. We have all heard about the founding of purebred flocks, about feeding too much fattening food, about proper barns, etc., but it seems to me that there should be a great deal of work done among the breeders themselves. Up until the past few years, the sheep business has been considered more or less like the Belton hare business; but recently the demand for wool and mutton, and the building up of pure bred herds have placed the sheep industry clear at the top. Some breeders don't like to start into the business by themselves, either with grades or with purebreds; they are afraid they will not have a good sale for their wool or mutton, or, if raising purebred rams, they are afraid they will not have a market for their surplus rams. This is one reason, I believe, why sheep men should unite. Few breeders are strong enough to stand by themselves. If producing mutton for the market, if a few breeders in one locality will get together and produce sheep of a certain type, they will get a better sale and better prices. When a breeder wants to ship, and has not a car load, several breeders can put their sheep together and make a car load, getting better rates in this way from the railroad. And when breeders unite and talk things over, they will produce lambs of a uniform type, and this is very important to get the highest price. In buying rams, a great many breeders, by themselves, don't feel like they want to pay a price for the kind that will bring good results.

I have been spending all of my time in the past few years in the sheep business, and I find that a great many of the breeders who come to our farm don't like to invest in the best grades of rams, and if they want to start in the sheep business they don't like to buy the best, because they feel that they won't get a good price in return. Especially in the purebred business (and I believe that that is the one that appeals to most of us), they must work together, in order to get a reputation that will draw breeders from outside parts of this State and from other states. By themselves, they might sell part of them around home, but they can not expect to do much business far from home.

The best lambs will sell readily to small farmers throughout the corn-belt, but those that are not just up to the highest class must go where people won't pay quite such a price, and where the business has not made such advance, and that is in the west. The breeders from the west come east to breeders whom they know, who have a reputation, whose sheep have been of such a quality that it has created a demand for them. If breeders would work together and get sheep in larger flocks, and get up a reputation, then they could draw these western buyers to them. The advancement made in the sheep business in Missouri has been so great that it seems to me that Missouri breeders could get together now and work up fine prospects. With the great numbers of sheep that have been brought into this State, it seems to me that with the help of this association great profits should be derived from this industry. It is true that the best class of breeding material will tell, and especially I believe that we must pay a great deal of attention to English blood. Our cattle are as good as those of England, but their sheep are far ahead of ours.

As I have said, the sheep business up until recently has not received much attention, and that is the reason we are behind in the breeding of sheep. England has been breeding up for centuries.

Of course, pedigree is not to be considered of greater importance than individual merit, but from experience in breeding we find that pedigree is very important in the sheep. Take the English sheep brought to this country, and they will breed for seven or eight generations, so that the lambs are of a uniform, high class type. Sheep in this country, although registered, may be bred only for one or two generations of the really high class type, and when bred longer, the unsuitable characteristics of their ancestors will be in evidence sooner or later, and even the people in the west want the best class of animals, and they must be of uniform type. The market calls for more uniform type than ever before. In the purebreds and grades we must pay more attention to type. Of course all the advancement that has been made in our grade sheep, I believe is due to the introduction of pure blood; and the greatest advancement in pure breds has been from the introduction of English blood. Therefore, those breeders who have at heart the welfare of the industry, and who, apart from making a profiit for themselves, want to help advance the industry in this country, will do well to ship sheep from England, and then sell their produce to breeders of this country who do not feel that they can pay the price, or who have not the experience that makes them feel that they can start in the business; and the breeders here today, who will work together and help each other, both in the production of mutton and wool, in the grade and in the purebred business, will accomplish a great deal more than if they work by themselves.

SELECTION OF A FOUNDATION FLOCK.

(By Donald A. Green, Oakland, Ill.)

Before attempting to become breeders of purebred stock we should consider several things: Are we to become breeders or just multipliers? If the latter, we have already far too many and not enough of the first mentioned. Are we capable of becoming successful breeders? Have we the instinct to select and mate successfully? With some this instinct is acquired by experience with stud, flock or herd, with others it is born in them.

In selecting the foundation flock, we must be very, very careful, for a mistake at the start may multiply a hundredfold, and mean disaster in the end.

First, we must consider from the mutton and wool standpoint, for are not the woolen mill and the butcher's block the final test?

Second, we must take up breed type and the several other things that together compose the important points in a foundation flock. As my experience has been with Shropshires—both a mutton and a wool breed—I will use them to illustrate my discussion, though the same ideas will apply to any mutton and wool breed except the breed type.

First, the mutton form—for I think this the most important at the present day. For a good mutton form, we must have a very wide sprung rib; a straight spine (no drop behind the shoulders); the shoulders smooth on top and wide in proportion to the rest of the body; the chest deep and full, denoting a strong constitution; the loin wide; the hips broad, carrying the width well back to the tailhead, and dropping much from a line with spine; the leg-of-mutton full and well-fleshed down to hocks; the neck short and smoothly fitted to shoulder; also, the body should be well covered with natural flesh all over, especially the back and loin. The face should be short and broad, the legs short and straight, setting on each corner. These latter points denote quality.

To illustrate what I mean by *the legs setting on each corner*, I will relate an illustration made by "Uncle Dick" Stone to a city man who didn't know very much about sheep. (This happened at the Missouri State Fair year before last.) Dick was showing this city chap the proper way a sheep's legs should set on. Said he: "See this imported lamb's legs set on each corner supporting a good leg-of-mutton, while this here Missouri lamb's legs all come out of the same hole and his owner has trained him to stand with them apart until they have grown crooked." I think quality might also be mentioned along with good mutton form, since it plays so important a part, both in the market and the show-ring.

To have what we call "lots of quality," a sheep must be very compact, symmetrical, features refined, but not delicate, the bone short and strong, but not out of proportion with the rest of the body. I have noticed that, except in rare instances, our American-bred sheep tend to have a finer bone each succeeding generation, unless very close care is given to the feeding, (then it is noticeable but not so clearly), while the sheep coming from Great Britain have a much stronger bone, in some instances inclining to coarseness, but their offspring show the same tendency as the American bred.

Two things may account for this: Climatic and domestic conditions. Darwin, in his great work, "The Origin of Species," says that sheep are more quickly affected by changes of climate and domestic conditions than any other of our domestic animals. If this be true, we must select animals with heavy bone, even though they seem to be a little coarse.

As stated before, wool is an important factor; therefore, we want as many pounds as possible so long as we can keep the quality. In examining a sheep's fleece, the first thing we want to look for is evenness of length, density and quality all over the body, keeping a sharp outlook for hemp or hair and black fiber. For good weight of wool, the sheep should have as long a fiber and as dense as possible, with wool all over the body, legs and face.

Breed Type—Something that has been the ruin of more than one good stud, flock or herd. Too many people let breed-type and breeding make fools of them. Breed type must be considerd, but do not discard an animal for the simple reason that the type does not exactly suit you, for an animal whose type is right, but nothing else, for neither is desirable. Several points go to make up the breed type: General form, shape of the ear and head, fleece, color of the hair, etc., all of which must be taken into consideration. You hear people say that a certain sheep "had the breeding behind him." They may have two meanings for this: One that his ancestors were prize-winners or the producers of prize-winners; the other, that the sheep may have come from some noted stud flock whose owner had the rare gift to mate and select successfully. For instance, at the last International a French Rambouillet ram sold to the United States government for $425. In everything but breeding this ram was a miserable joke. At the 1906 International, a Shropshire ram lamb sold for $305. This lamb possessed everything that a Shropshire breeder would ask for—breeding, type, mutton form, the fleece and the quality. There were other lambs that went through the sale ring, with just as good breeding, that did not bring $40. The same day that the Rambouillet ram sold, there were far better rams sold—except in breeding—that didn't bring $100. Breeding is all right—but be sure to buy some sheep with it. We often see breeders leaving everything else out but one, two or three points, but they sooner or later go out of the business. Take everything into consideration.

Those who have had experience with stud flocks know that it is seldom that we find a ram or a ewe that are producers of both good rams and good ewes, while it is common to find a good ram breeder or a good ewe breeder; therefore, we must let experience guide us in our selection. A ewe showing too much masculinity or a ram too much femininity are to be avoided, although they be suitable in every other way; for such animals are apt to produce offspring that are not uniform.

The ewe should *look like a ewe,* having that timid, feminine appearance; the ram should be the opposite, showing a bold, masculine appearance, strong head, neck and shoulders, but not too much out of proportion with the rest of the body. A little coarseness is not so objectionable in a ram. I like to see a ram that is ready to knock his shepherd over, or whip the other ram from the feed; then I know his lambs will stand the knocks that would kill the lambs from a ram that is willing to let some other ram have his share of the feed.

In selecting ewes for my reserve breeding flock, I use this system: I stand off and note their general form and breed type, also that they have a determined, stylish action, and feminine appearance; I examine their mutton form, as described in the beginning—if the mutton form is right, the constitution is sure to be right also; I examine the fleece for the points described, on the side midway between the hips and shoulder, on the hip, well down on the thigh, on the belly, on the top of the head, and on the cheek. In the ram I look for the same things, except that I watch out for scurr or horns, and see that he shows plenty of masculinity, as I have before described. IF A SHEEP LACKS IN ONE SINGLE POINT, DON'T PUT IT IN YOUR FOUNDATION FLOCK.

Now, in conclusion, a few don'ts:

Don't stand back because of a few dollars when you find a ram or a ewe that suits you—the best are by far the cheapest in the end.

Don't let any man have his choice of your ewe flock, or he will be selling you stud rams, the first thing you know.

Don't go into the business for the dollars alone—if you do, you will never make a success, either financially or as a breeder. Go into it for the pleasure of breeding and improving purebred sheep, and the dollars and success are both certain.

A BOY WITH A FEW SHEEP.

(Hon. J. W. Boles, Auxvasse, Mo.)

When Governor Colman delivered his able speech yesterday on teaching boys how to tell what they know, I was very much impressed with the importance of people being anxious to tell others their experiences wherein they have been successful.

When I received word that I was to give a talk on this subject, I wrote an inquiry to one of my county papers, asking those who had handled a few sheep to give me their experience as to their success or failure. I got a few answers to my inquiry. From the information that I have gathered I conclude that a larger per cent. is made on a little money invested in a few sheep than in any other kind of live stock.

We handle stock because we like it, and for the money there is in it. It is hard to succeed in a business that we do not like; so it is very necessary that we choose a vocation that we like, and then go after it with the determination to succeed. If you can handle sheep and will take care of them, they will make you good money, and do your farm good. I have given the sheep business my special attention for fourteen years, and have had the experience of many who have handled them. I find that a large majority of them have made a hundred per cent. or more, annually. The expense of one cow is equal to that of about eight sheep. A forty dollar cow will raise you a twelve to twenty dollar calf each year. Eight five dollar ewes will raise you forty dollars worth of wool and lambs, annually. The cow makes you thirty to forty per cent., while the sheep make a hundred per cent. A hundred dollar mare will raise a thirty to forty dollar colt, making from thirty to forty per cent. A two hundred dollar mare will raise a colt worth from sixty to one hundred dollars, the same per cent. as above. A seventy-five to one hundred dollar pure bred cow will raise a thirty-five to seventy-five dollar calf. Eight twenty-five dollar pure bred ewes will raise eight twenty to thirty dollar lambs, all sold as yearlings, and the ewes making from eighty-five to one hundred and twenty per cent. The higher grade the stock, the more money you make. The cost of keeping of the above stock is about equal. A good sow will come nearer making as great a per cent. as the same amount of money invested in sheep, but will cost more and is not so nice to handle. Sheep will eat the weeds on the farm and clean it up generally and make a good sod. Broken or hilly land is better for sheep than for any other stock.

I bought two ewes at $40 each; one of them paid for herself two or three times, and the other never made me a cent. Just here it might be well to say something about the kind to buy. The ewe that did me no good was shown for two seasons; she was so fat I could not get her to breed. The other was shown one season.

It is not good policy to buy show stock or overfeed stock for breeders. I would not advise a beginner to buy very old ewes to start with, unless he is able to give them special care, for they are liable to go down on him and discourage him. Better buy a few, from two to four years old, and take good care of them and breed them to a hig class, purebred ram. I would not buy scrubs at any price.

Before you begin in the sheep business, acquaint yourself with the different breeds, and buy the kind that suits you best. Do not buy anything that is called a sheep, simply because it is a sheep.

I read an account of two neighbors who bought of the same flock and of the same grade at the same price. One man made good money, the other lost almost all his money. One took care of his sheep, the other did not. We must keep our sheep clear of disease if we would succeed. I know of a great many instances where men have lost money on sheep. I have a neighbor who neglected to dip his sheep, and by so doing, he let the lice damage them very much. Sheep are nice stock to handle, and will make money if properly cared for. Neglect will lose money in any business.

FLOCK MANAGEMENT.

(By Edwin R. Stroeter, Kearney, Mo.)

(First prize article written in competition for the best description of practical flock management. The prize was offered by the International Live Stock Exposition, 1908, through the courtesy of Woods Bros. Commission firm of Chicago.)

My experience with "Flock Management" has not been with pure bred sheep to supply the breeders market, but with the western ewe, bred to pure bred rams, to furnish early lambs for the consumers' market. So under this method of management I have two important objects in view. My first desire is to secure an early, quick maturing lamb that demands a good price when marketed; my second, to get as large a clip of wool as possible under this system of management.

My breeding flock consists of 100 western ewes, from two to five years old, that show blood from some of the down or middle wool breeds, viz.: Shropshire, Hampshire and Southdown. I prefer this kind of ewes to the regular western Merino ewes or a cross of the Merino and the long wool breeds. I select ewes having a strong constitution, which I consider is absolutely necessary to make a mother that will suckle her young well. I am very careful to get sheep that are well wooled on all places and with a cross between the Merino and the middlewool breeds, as above named, I get a moderately dense fleece and a medium length staple.

My method of managing the flock from the time the lamb is weaned till breeding time, which is approximately from June the 1st, till August 1st, is as follows:

Summer care of the flock is easy if you have plenty of grass, water and shade. I always have good pastures, being either legumes or grasses. Personally, I prefer blue grass slightly mixed with white clover, as legumes are apt to get the ewes too fat before breeding time. I never allow the flock to stay longer than three weeks in one pasture without changing to new quarters. By these frequent changes I lessen the danger of infection by parasites, which is apt to come from too close grazing of pastures. A frequent change also gives the flock a chance to select the things most palatable to them,

My sheep always have access to shade and penty of fresh water. I am of the opinion that standing water is always more or less infected with dangerous parasites.

My only means of protection against the gad fly is to plow a few furrows where the sheep stand in the shade.

A close watch must be kept throughout the summer to keep all tags sheared off and the worms kept out of the wool, caused by wet tags. I also note the general health, so that parasites will not get the start of me.

Salt is kept in the pasture all the time. I do not feed salt alone, but a mixture which I have used and found very helpful in combating parasites, especially stomach worms. The formula is as follows:

Salt	1 bushel.
Air slacked lime.	1 peck.
Sulphur.	1 gallon.
Pulverized resin.	2 quarts.
Copperas.	1 lb.

Another good way to combat stomach worms is to increase the woody or fibrous content of the stomach, which can easily be done by turning the flock in a corn field, so that the sheep will have the greater portion of their ration consisting of corn blades. I have found this treatment very efficient.

When breeding time comes I always have my ewes in good flesh, but not too fat. About two weeks or ten days before breeding I begin "flushing" the flock. This is accomplished by providing an excellent pasture and its object being to hasten the ewes to breed. I also believe it increases the percentage of lambs dropped.

Breeding time depends somewhat on the weather. I always try to begin breeding August 1st, if the weather is any ways cool. The flock is divided into three bunches, each bunch being selected so that it will cross good with its ram. In breeding this early it is necessary to allow the ram to remain with the flock longer than when you breed later in the season, so I leave my rams with the ewes two months and even then some ewes fail to breed.

With the grade of ewes I handle, I have found that a well-bred Shropshire ram is hard to beat in producing the early maturing marketable lamb that I desire. I have found the Hampshire to do real well also, but the lambs are not so early maturing. I intend to try a Dorset ram in the near future and I believe good results will be gotten. I have tried the Cotswold and find the product to be rather coarse, slow maturing, leggy lambs, with a weak constitution. This cross certainly makes a poor milking mother.

I want my rams to show good breeding, a vigorous constitution, a conformation that distinctly shows early maturity and to be well wooled.

During the breeding period I always feed the rams extra, as they are sure to get thin if not given extra attention.

After breeding time I provide green pasture for my ewes as late as possible, which I very successfully do by having blue grass pastures that have not been grazed during the fall, or by winter rye.

The dry feeds I use for pregnant ewes are as follows: second crop clover hay, stover, corn, oats, bran, turnips and sometimes, pumpkins.

I always allow the flock to stand to hay all night giving them just what they will clean up and every morning feed one shock of stover (sixteen hills square). When I feed pumpkins, which is about once a week until Thanksgiving time, I just cut them in halves and throw them on the grass. Turnips are fed sliced, mixed with the grain. Even if sheep have a good late pasture, they enjoy a change and like to eat good clover hay at night, and a little stover each morning also goes well. What they refuse to eat the cattle will soon clean up.

The amount of grain fed per head depends on the condition of the pastures. If the grass is short I feed approximately ½ lb. sliced turnips, ¼ lb. corn and ¼ lb. oats per head daily until two or three weeks before lambing time, when I take away the corn entirely and feed ¾ lb. turnips and ½ lb. oats or ¼ lb. oats and ¼ lb. bran per head daily. The roughness remains the same.

Some of my neighbors have laughed at me and have said that I feed my sheep too much, but at lambing time many of them complained of their ewes not giving milk, which very seldom gives me any trouble. I attribute my success here to my liberal feeding. I never shut my ewes up in a close barn at night, unless it is very stormy, but they have access to a long shed 16x60 ft. with a hay rack on each side, and well ventilated with windows and doors. Good ventilation in the barn and plenty of exercise are very important factors for the pregnant ewe.

Just before lambing, I give the ewes fresh winter pasture, as wheat or rye, which gives a healthy tone to the system and increases the milk flow. Here is where mothers are often deficient at first but I find by giving the ewe winter pasture this obstacle is overcome. I also find the young lamb will begin to eat grain sooner when given winter pasture to run on than when just started on dry feed alone.

At lambing time, which runs from the first of January till the first of March, I nearly live in the sheep barn. I always pick out the ewes farthest advanced towards lambing and separate them from the rest of the flock to another barn in which I have a stove. I do not use the stove unless it gets very cold, so that there is danger of chilling the young lamb. I again divide these ewes in lots of five or six each, by means of little pens, so that when a lamb is dropped it cannot stray very far away from its mother. Often when twins are dropped the first one will stray off among the flock and then the mother will not claim it. But where there are only a few sheep in a pen the mother can keep up with both. As soon as I find a new comer I separate in a single, small pen for several days until the mother and lamb or lambs know each other well. First thing I do when I find a newly-made mother is to draw some milk from the udder to make sure the milk flow is all right.

Sometimes a young lamb must be fed by hand for awhile, as it may be too weak to take care of itself or because the mother has no milk. When I have to do this I take fresh cows milk and add one-fifth water and feed quite warm. Be sure the bottles are absolutely clean and sweet.

Often you find mothers that give more milk than the lamb can use and I find if this surplus is not milked out you are apt to have a dead lamb.

Then again, you will find a chilled lamb occasionally. I find a bath in fairly hot water in connection with just a little mother's milk has given the best results here.

I casterate my lambs when from seven to ten days old, provided the weather is suitable. Never allow them to get larger than you possibly can help. I cut off the end of scrotum and draw out the testicles, cord and all.

The docking is done about the same age by means of a docking pinchers, heated red hot, so this does away with the bleeding. I prefer a tail docked rather short.

At first I did not dock or casterate either, but soon saw the casterated lambs did better, very often brought more on the market and then you can hold them over if you wish, but an uncasterated lamb must go to market rather early.

For the first ten days after a ewe gives birth to a lamb I increase the root and bran ration some, but thereafter, I gradually increase the feed until I am feeding ¼ lb. bran, ¼ lb. oats, ⅓ lb. corn and ¼ lb. roots (turnips).

I get the lambs to eating grain as soon as possible and have a lamb creep, in which I have a ration of equal parts of corn, oats and bran. The roughness consists of clover hay and they also have access to the winter pasture. I also manage to have about five acres of early rape on which I finish the lambs in connection with the above grain ration. I do not let the mothers run on the rape.

The following weights show the gains these three lambs made, white faced lamb on left of picture:

White-faced lamb on left—		
Weight February 13th..........	12 lbs...........................	......................24 hrs. old.
" March 13th............	35 lbs...........................	....................30 days old.
" March 27th......	43 ⅓ lbs........................	....................42 days old.
" April 13th............	68 lbs...........................	......................60 days old.
The middle lamb—		
Weight March 13th...........	32 lbs...........................	....about 32 days old.
" April 13th.............	52 lbs...........................	..............two months old.
Lamb to the right—		
Weight March 13th...........	33 lbs...........................	..............about 32 days old.
" April 13th	50 lbs...........................	......................62 days old.

EARLY LAMBS.
On Farm of E. R. Stroeter.

I generally shear about May 1st and use the machine clipper. The wool is tied in cubical blocks by means of a wool press. The blocks are about eleven inches square and tied with wool twine three times each way. The thickness of the blocks depends on the size of the fleece. I am always complimented on the neat appearance of my wool when marketed. My ewes average about 8 lbs. of wool per head yearly.

I never keep the same bunch of ewes longer than three years, as I get better results by changing. I also cull out barren ewes or ewes that have raised a poor lamb every fall. I fatten old ewes and wethers in the fall, up to about the middle of December. I usually fatten by turning in a corn field in which rape and cowpeas have been sown at last cultivation of corn. I prefer this method but corn and clover hay have given me good gains and an excellent quality of dressed mutton.

My loss of sheep is not very great, and what few I do lose die just shortly before lambing time.

I always try and market my lambs as early as possible, but this year a person hardly knew when to sell on account of such a change in the market. I marketed my first the second week in June. This year, 1908, I decided to keep back my best ewe lambs for breeding, as the market was low and I hated to see such choice ewe lambs go at a low figure.

Following is the financial statement of my sheep operations up to the present time for this year:

794 lbs. wool at 13½c per lb.	$107.19
6 sheep pelts at 80c each	4.80
40 lambs, weighing 75 lbs. each at $5.75 per 100 lbs	172.50
40 picked ewe lambs, valued the same	172.50
36 lambs left.	
116 Total	$456.99
Or 116% to my entire ewe flock.	

Counting just the ewes that brought lambs, I made an average of 126 per cent this year.

The 36 lambs I still have are on full feed of corn, clover-hay and blue grass to run on. They will weigh about 85 lb. So there is yet quite an item to be added to my financial report for this year.

SHEEP FARMING IN MISSOURI.*

(By F. B. Mumford, Professor of Animal Husbandry, University of Missouri.)

No state in the middle west is more justly entitled to be called a sheep state than is Missouri. In 1908 Missouri had a larger investment in sheep than any adjoining state. Her sheep possessions amounted to more than 300,000 above those of Illinois or Iowa. Great interest has been aroused in recent years in sheep production in the corn belt states. The Missouri Sheep Breeders Association is the largest similar organization in the United States. There has likewise been marked improvement in the quality of Missouri sheep in the past four years. The best indication of increased interest in the production of a high class of sheep is shown by the increased value per head. The average value per head of Missouri sheep has increased more during the past four years than in any other middle west state. There is still opportunity for large improvement in this direction.

THE SHEEP FARMER.

In every clime and on every kind of soil the domestic sheep has demonstrated its ability to thrive and yield profitable returns to the shepherd. From British Columbia to Panama, from Tunis to Cape Colony, and from Brazil to the southern-most point of

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*From Monthly Bulletin State Board of Agriculture.

South America, the sheep has readily adapted itself to the uses of man.

Its time-earned value as an improver of soils is more and more recognized by the farmers of the middle west. Its efficiency in cleaning land of weeds has been clearly demonstrated in every section of the United States. Sheep will eat 100 kinds of weeds that are wholly unpalatable to cattle. Among the domestic animals perhaps no other class of live stock requires so little labor in its successful care and management.

The domestic animal on the farm is to be regarded as an animal machine. Its efficiency in the consumption of food is a controlling factor in live stock operations. In this regard the sheep stands in a class by itself among ruminant animals. The amount of grain required to make a pound of gain on sheep as compared with other animals is shown in the following table:*

TABLE. I† GRAIN REQUIRED FOR 100 LBS. GAIN—DRY LOT.

Ration.	Cattle.		Hogs.	Sheep.	
	Grain, Pounds.	Hay, Pounds.	Grain, Pounds.	Grain Pounds.	Hay, Pounds.
Corn	1,080	457	500	420	458
Oats			421	331	595
Barley	914		446	305	
Peas			452	549	Pastured
Varied (with roots or silage)	712	572	359	370	382
Varied	953	292	431	326	422
Average	914	440	435	383	464

TABLE II. YOUNG ANIMALS—GRAIN REQUIRED FOR 100 LBS. GAIN—ALL RECEIVE SKIM MILK.

Calves, 432 lbs.	Pigs, 320 lbs.	Lambs, 284 lbs.

TABLE III. GRAIN REQUIRED FOR 100 LBS. GAIN ON PASTURE.

Cattle, 830 lbs.	Hogs, 398 lbs.	Sheep, 245 lbs.

It will be seen from the above tables that the sheep is one of the most efficient meat producing animals on the farm.

The disadvantages that are to be mentioned in connection with sheep farming are that sheep are subject to certain diseases. Internal parasites, such as stomach worm and tape worm, have in the past been fatal to large numbers of lambs. The nodular disease has probably been fatal in a smaller number of cases. In recent years, however, methods of prevention have been discovered which largely eliminate the losses heretofore common in the breeding flocks of the country.

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*Missouri State Board of Agriculture, 1907.

†Table I was compiled from many experiment station reports.

ORIGIN OF THE DOMESTIC SHEEP.

The sheep was one of the earliest animals domesticated by man. The ease with which it could be captured, confined and maintained, facilitated greatly the progress of its complete domestication. The fleece provided warm clothing and the flesh a healthful and nutritious food. All these contributed greatly to the rapid development of man toward civilization.

European and Asiatic sheep are supposed to have been descended from the Argali or wild sheep of Asia, and the Musmon of the south of Europe. The African sheep is similarly derived from related species found on that continent. The Argali of Asia is larger than the domesticated sheep, being somewhat smaller than the stag, and possessing enormous horns, three or four feet long, and sometimes a foot in circumference at the base of the horns. The color of fur is brown, with a buff-colored streak along the back and a large spot of buff color on the haunch.

All the wild cousins of the domestic sheep prefer the higher altitudes, choosing the rocky, precipitous mountains covered with sparse vegetation. They are exceedingly agile, strong and wary.

The Rocky Mountain sheep is the Argali of America. This beautiful animal ranges the highest altitudes of the lofty Rockies and is so wary and agile that none but the most experienced hunters are able to secure them.

It is probable that most of our modern varieties of sheep have descended directly from the Musmon, whose native habitat seems to have been the Islands of Crete and Cypress and the mountains of Greece. They still roam wild in Corsica and Sardinia. Smaller than the American Argali, less powerful and active than the European or Asiatic Argali, they range the lower altitudes and less inaccessible ranges of mountains. They usually roam in large herds and seem not to be easily domesticated.

Among the varieties of domestic sheep are many of more or less unusual characteristics. Among these are the fat tailed sheep of Asia Minor, Syria, Arabia, and South Africa. These sheep are distinguished by an enormous development of fat deposited in the tail. There are reports of individuals having accumulations of fat in the tail amounting to more than fifty pounds. Another somewhat unusual type of sheep is the fat haunched sheep. This animal is peculiar in having an unusual development of fat on the haunches. This type of sheep is found north of the Caucasian Mountains.

BREEDS OF SHEEP.

A rather general classification divides sheep into wool and mutton breeds. The wool breeds of sheep include all the varieties of the Merino; the American Merino, the National Delaine, the Dickinson and the Blacktop. The best representative of the foreign Merino is the Rambouillet. The mutton breeds include the coarse or long wool varieties, the Cotswold, Lincoln and Leicester; the middle wool breeds, the Shropshire, Hampshire, Oxford, Southdown, Dorset Horned and others. All of these breeds have their peculiar value under certain conditions. No class of sheep has proven more efficient, all things considered, for the ranges of the west than some form of the Merino breeds. On the fenced farms of the middle west in recent years some type of mutton sheep has more often been selected.

IN A MISSOURI FEED LOT.

SYSTEMS OF SHEEP FARMING.

The sheep of the United States are produced under varying conditions, and these have resulted in the development of certain types of sheep farming, especially adapted to local conditions. In the middle west two types of sheep husbandry particularly are common. The first type includes the keeping of a small flock of sheep on a general farm, either a grain farm or a stock farm, and this type of sheep husbandry is very common throughout this section. To be distinguished from this is the special sheep farm on which sheep are the principal source of revenue, and the cropping systems of the farm are arranged with a view primarily to their adaptability to the feeding and handling of sheep.

Both wool and mutton are items of profit to the sheep farmer of the middle west, but it is probably correct to say that in very few cases are sheep now reared for wool alone in the north central states. The most common type of sheep farm in the middle west at present, is one carried on primarily for the production of mutton lambs, either to be sold in the spring as so-called winter or hot house lambs, or to be carried through the summer and either sold to feeders to fatten during the winter or to be fattened by the owner. It is this type of farming particularly considered in this bulletin.

SELECTING THE EWE FLOCK.

The kind of ewes to select for the commercial production of mutton on the middle west farm is a matter of first importance in beginning the business of sheep raising. The available supply of ewes is to be secured from two sources, first western ewes, and second, natives. The selection of western ewes as a foundation flock for mutton production has some advantages not possessed by

HIGH CLASS SHROPSHIRE EWES.

Owned by the Department of Animal Husbandry, University of Missouri.

A PRIZE WINNING SOUTHDOWN WETHER.

Owned by the Department of Animal Husbandry, University of Missouri.

the native ewe flocks. The western ewe is usually uniform in size, age, breeding and condition. They are almost universally free from the destructive internal parasites, common to the native flocks. They may be had in flocks of any ordinary size at most seasons of the year, but particularly in the late summer and fall. The native ewes, on the other hand, are apt to be of mixed breeding of varying ages and, owing to small flocks, only a comparatively small number may be purchased at a time, but probably the most serious objections to native ewes is that they are usually badly infested with tape worms, stomach worms, and often with nodular disease.

It has been claimed by men who have had considerable experience that the western ewes are very satisfactory for a year or two, but do not thrive well after they have been maintained on fenced farms for more than two or three years. It is possible that this result may come from infestation of parasites, but whatever the reason, the facts seem to be that in extensive methods of sheep production it will generally be found most practical to dispose of the western ewes every one or two years and buy new flocks.

For the production of winter or hot-house lambs, it is undoubtedly better to secure western ewes, showing some blood of the Hampshire, Shropshire, or other Down breeds. Ewes showing, however, a large amount of Merino blood are successfully maintained, both for hot-house lambs and for ordinary summer lamb production.

SELECTING THE RAM.

The best breed of rams to cross on ewes, such as those described in the preceding paragraphs, will probably be found among the middle wool or Down breeds of sheep. The Shropshire, Hampshire, Southdown or Oxford breeds have been found altogether satisfactory for this type of sheep farming. In selecting the individual ram it will be found profitable to buy a pure-bred registered animal of a high degree of excellence. The ram should be of good size, preferably one or two years old, showing the true mutton type with broad, well covered back, carrying the width evenly from shoulder to loin, and comparatively level to the tail head. The top and bottom line should be straight, the back strong, the skin a pink color, the eyes vigorous and clear. A broad, deep chest will be indicative of a strong, vigorous constitution.

REGISTERED PURE BRED RAMS.
At a Missouri County Fair.

MATING THE EWES.

The ewe flock should be in a thrifty and well-nourished condition when they are bred to the ram. It is highly important that every ewe should be improving in condition when bred. The best shepherds accomplish this result by "flushing" the ewes. The practice of flushing is accomplished by turning the ewes on a fresh pasture two weeks before it is desired to breed them.

One ram for forty or fifty ewes is the right proportion. It is always better to keep the ram in a small grass lot provided with shade during the day and turn him in with the ewes at night. It is desirable to have the lambs come as close together as possible, and the above methods will both contribute to this result.

The period of gestation in ewes is 145 to 150 days, so that if it is desired to have the lambs dropped in February the ewes should be bred in September.

CROPPING SYSTEM FOR A SHEEP FARM.

A satisfactory cropping system for a sheep farm must in the first place be such as to maintain, and, if possible, improve the productiveness of the soil, and at the same time provide the proper quantity and quality of feed for the ewes and lambs throughout the year. In addition, the system of cropping should be such as to reduce to the minimum the labor required, and be so arranged as to eliminate, as far as possible, the loss from internal parasites. In order to give due weight to all of the factors involved, it is best to provide a main rotation and an accessory rotation, such as is described below.

In the corn belt the main crop should always be corn. Successful rotations under present conditions on land of reasonable fertility should include more than one crop of corn in a four-year rotation.

A 120-ACRE SHEEP FARM.

The size of the average Missouri farm is 120 acres. Assuming that 100 acres of this land is tillable, and that 20 acres of it is suitable for permanent pasture, the following method of management will be found highly satisfactory where the principal business of the farm is the production of fat lambs.

Every system of farm management should be so arranged as to provide first for the maintenance of the fertility of the soil. In this relation sheep fortunately have long been recognized as among the most efficient of the domestic animals in maintaining and improving soil areas.

In any system of stock farm management there are two general lines of effort under which most of the farm activities may be grouped. These are the production of crops and the utilizing of these crops by feeding to animals. Considering first the cropping system, it is suggested that the 120-acre farm be divided into six twenty-acre fields by permanent fences. Twenty acres of this farm should be kept in permanent pasture and the ordinary blue grass pasture of Missouri will be greatly improved for sheep by the addition of white clover, which may be sown in the spring on the blue grass pasture, and will be more apt to catch well if the pasture is harrowed with a spike tooth harrow. Four of the 20-acre fields are to be used in a primary rotation as follows:

PRIMARY ROTATION—(120 ACRES.)

(20 Acres in each field.)

No. of field.	First Year.	Second Year.	Third Year.	Fourth Year.
1	Corn and cowpeas	Corn and rye	Rye seeded to clover	Clover.
2	Corn and rye	Rye	Clover	Corn and cowpeas.
3	Rye	Clover	Corn and cowpeas	Corn and rye.
4	Clover	Corn and cowpeas	Corn and rye	Rye..
5	Permanent pasture.			
6	Accessory rotation,			

See page —.

By following the above rotation there will be each year, 40 acres of corn, 20 acres of rye and 20 acres of clover to be harvested for winter and fall feeding. The cowpeas are to be planted in the corn with a one-horse drill at the time of the last cultivation, at the about the 15th of September, also by means of a one-horse drill, or it may be broadcasted at the rate of two bushels per acre, and harrowed in with some implement which will go between the corn rows. The clover is to be seeded on the rye in February each year, except in certain districts where the clover may better be sown on the rye in the fall at the time of seeding. One objection to the above rotation is that it does not provide sufficient summer feed for the ewe flock, and to provide for this we have prepared the accessory rotation, which follows:

ACCESSORY ROTATION (20 ACRES.)

(Five acres in each field.)

No. of field.	First Year.	Second Year.	Third Year.	Fourth Year.
6a	Rape and oats	Corn and rye	Rye pasture	Soybeans.
6b	Soybeans	Rape and oats	Corn and rye	Rye.
6c	Corn and rye	Rye pasture	Soybeans	Rape and oats.
6d	Rye pasture	Soybeans	Rape and oats	Corn.

The lot divisions in field No. 6 may be all temporary fences, or if more convenient, the fences may be permanently constructed.

DIRECTIONS FOR ACCESSORY ROTATIONS.

Rape and oats should be planted in the proportions of five pounds rape and one bushel of oats per acre as early in the spring as possible. Rape and oats are to be pastured off when the crop is from 12 to 18 inches high.

Rye is to be sown in the corn about September 15, at the rate of two bushels per acre.

The rye crop is to be left to mature on the ground, and when the rye stems begin to break down turn in the lambs to fatten on the grain. If the lambs are taken off early enough there will be a good crop of volunteer rye for winter and spring pasture.

Following the rye the next year soybeans or cowpeas are to be planted from May 25 to June 1. This crop may be either broadcasted or planted in rows three feet apart.

It is intended that all the crops except corn in the accessory rotation shall be pastured off the ground by the sheep in the manner suggested above. In those years when these crops are not needed for pasture they may be harvested for grain or hay.

On good land such a system of sheep farming could be man-

A FINE TYPE OF DELAINE MERINO.

Bred in Missouri and owned by the University of Missouri.

aged to handle 150 high-class breeding ewes and fatten their lambs annually. In addition four or five brood sows and their litters could be raised and fed off each year.

Perhaps the best result of all in this system is that the soil will unquestionably improve in fertility. This applies particularly to soils that are somewhat run down or worn out.

WINTER CARE OF THE EWE FLOCK.

In handling successfully a flock of breeding ewes it must never be forgotten that they are breeding animals, and that the kind of treatment most successful for the production of strong, healthy lambs is not necessarily the best treatment for a flock of fattening lambs or wethers. A prime essential for the successful handling of breeding ewes is abundant exercise throughout the year, and especially during the winter. It is a grave mistake to confine the ewe flock to limited quarters during winter. Shelter is necessary, but warm shelters are to be avoided. An ideal shelter for sheep of any kind is a shed tightly built on the north, east and west sides, but entirely open to the south. Sheep suffer more from cold, wet rains than from any other cause in the winter. If they can be protected from such rains and given a dry place wherein to lie down they will have been supplied with the best possible conditions for such animals.

DIPPING.

Sheep often suffer severely from external parasites, as well as from internal troubles. The most common external parasite is the ordinary sheep tick (Melophagus ovinus). This pest is nearly always present, especially in flocks of open-wooled sheep. Fortunately, it is comparatively easy and inexpensive to check the ravages of this mite. In the ordinary course of sheep farm management it is good practice to dip all sheep on the farm in the fall before putting them in winter quarters. In order to accomplish the dipping with the least expense and labor, a dipping tank of some kind is necessary. Galvanized iron tanks may be purchased which are made especially for this purpose, or they may be made of concrete or of any material which will make a tank of the right shape and size.

A good form of dipping tank is ten feet long at the top, four feet deep, sixteen inches wide at the top and six inches wide at the bottom. One side of the tank should be built on an incline, and on this incline is placed a cleated board, up which the sheep walk out of the dipping tank. Suitable pens for holding the sheep before going into the tank are necessary. The sheep should walk out of the dipping tank upon a water tight platform, so inclined as to drain back into the vat. This saves dipping material.

The writer has used many different kinds of dip. Some of them home-made, but most of them some kind of proprietary dip. Among the home-made dips which have been successfully used are lime and sulphur and tobacco. Formulas for compounding these preparations will be found on another page of this bulletin. Among the proprietary dips which have been successfully used are the coal tar preparations, variously named Zenoleum, Naphtholeum, Car Sul, Hygeno, MacDougal's Sheep Dip, and poisonous dips such as Cooper's Sheep Dip, and others. All of the coal tar preparations are improved by the addition of sulphur. Care should be taken to follow explicitly the directions on the packages of dip, and in all cases the dip should be warmed to a temperature of 105 to 110 degrees Fahrenheit. It is better to use soft water, and the addition of concentrated lye to the water until it has a soapy feel, will increase the efficiency of the dipping material. The sheep should be carefully protected from cold until the fleece is dry.

Another time to dip the ewe flock is in the spring, at shearing time. If the ewes are shorn after lambing, the ticks will leave the ewes in large numbers and collect on the lambs, and unless the lambs are dipped at this time the parasites will prey upon the lambs to such an extent as to interfere seriously with their growth. The writer has known lambs to die, and apparently from no other cause than the presence of a large number of ticks at this period in the life of the lamb.

WINTER FEEDING OF THE EWE FLOCK.

Providing the ewes secure the proper amount of exercise and are sheltered as suggested, the success of the flock at lambing time will depend very largely indeed upon the kind and amount of feed given the ewes. Fortunately, sheep require a large amount of roughage, and may be maintained at a comparatively small cost, providing the right kind of roughage is available. No better roughness for breeding ewes has been found than clover, alfalfa, cowpeas or soybean hay. If one has abundance of any one of these nitrogeneous feeds with good corn stover, they can maintain the breeding flock successfully by feeding a very small amount of grain. With this roughness not more than one-half pound per head of grain is required. A mixture of corn, oats and bran, equal parts by weight, is an excellent mixture. This may be modified by omitting the oats and feed two-thirds corn and one-third bran. Sheep may be well maintained on clover hay and shock corn, but on such a ration care should be taken not to feed more than one-half pound of grain per head per day until after the lambs have been dropped.

The feeding of timothy hay or large amounts of poor quality corn stover without a nitrogeneous roughage or some grain in the ration is a bad practice. Ewes fed in this manner often suffer from indigestion, and at lambing time the lambs come weak, the ewes yield a small amount of milk, and the result is a large percentage of loss among the young lambs.

Feeding shock corn is a practice to be generally recommended, providing the fodder may be scattered widely over a good blue grass pasture. If it is not well scattered the sheep will soon foul the fodder to such an extent that they will refuse to eat it. If the ewes go into winter in good strong condition and are fed as indicated above they will come to lambing time in strong condition and be able to rear successfully the lambs to weaning time. After the lambs have been born the grain ration may be gradually increased until the ewe is receiving one and one-half pounds of grain per day.

LAMBING TIME.

The most important time of the year for the shepherd is the period during which the ewes are dropping their lambs. Skillful attention and care at this time will yield greater results than the same expenditure of time and labor at any other period on the sheep farm. It frequently happens that ewes refuse to own their lambs, and in such cases probably the best method of correcting this is to put the ewe and her lamb or lambs into a small individual pen. These pens may be made of two panels four feet long by three feet high, hinged together at one end and provided with hooks at the other. These may be placed along the wall of the sheep barn in such a way as to provide a number of small pens four by four feet.

This method of confining the ewe and her lamb in a small enclosure is not always successful in making the ewe own her lamb. In cases where the ewe persistently refuses to assume her maternal duties, a stanchion, made on the plan of an ordinary cow stanchion, may be erected in one corner of the barn and the ewe tied in this stanchion so that she cannot injure her lamb. In the usual course of events the mother will cease to fight her offspring and will usually in a day or two own her lamb without further difficulty. The same method may be employed when a ewe has lost her lamb and it is desired to transfer one of a pair of twins from its own parent to the dead lamb's mother. Some of the old English shepherds practice various methods for making such transfers, sometimes successfully, but more often unsuccessfully. Some shepherds advise removing the skin from the dead lamb and tying it on the foster child. In some cases this simple method will cause the foster mother to own a strange lamb in a short time. It is also recommended that the milk from the foster mother be rubbed on the fleece of the strange lamb; however, this is not a very successful method.

FINISHING THE LAMB.

In the long run it is far more profitable to finish the lambs on the farm where they are raised than to sell them as feeder lambs to be finished by others. The cost of finishing the lambs will be greatly diminished if they are fed from birth to the time of sale. This applies, whether they are sold early as hot-house lambs or whether they are kept and sold in the early summer or in the fall.

The cheapest gains are always made on young animals. The

THESE TWIN HAMPSHIRE LAMBS WEIGHED 120 POUNDS AT 50 DAYS OLD.

Bred by the Department of Animal Husbandry, University of Missouri.

cheapest mutton is made from grain fed to lambs before weaning. In attempting to feed grain to lambs, a lamb creep or separate pen should be provided, into which the lambs may go, but from which the ewes are excluded. In this way the lambs will early learn to eat a large amount of grain, and this should be continued until the lambs are sold on the market.

At the present time there is a good market for well fattened lambs at any season of the year. The highest priced lambs are those weighing fifty to sixty pounds, and ready for sale from the first of May until the first of July. Such lambs are called "hot-house" or "winter" lambs, and bring a very high price in the city markets. In order to produce such lambs, it is important that the lambs be dropped in January or February.

FATTENING SHEEP AND LAMBS.

The finishing of feeder sheep and lambs has developed into a business of large proportions in the corn belt in recent years. Feeders buy in the western markets lambs, yearlings or wethers, ship them to the feed lots of the corn belt and feed them for a time until they are fat and send them to market. This has proven a very profitable practice.

FEEDER SHEEP.

There are two sources of feeder sheep for the man engaging in a sheep feeding business—the western sheep to be purchased in the great western markets and the natives which may be purchased in most localities in the State. The most common classes of feeder sheep in the market are lambs, yearlings and wethers. The different grades of lambs are variously known as fancy selected, choice, good, medium or common, these names being used to designate the quality, breeding and condition of the feeder lambs. Yearlings are graded as choice, good or common, wethers as choice, good, medium or common. There are also offered on most markets three other classes known as bucks and stags and ewes. The most successful feeders have quite generally come to regard the western feeder sheep as much more desirable than the natives. They are more free from diseases, more uniform in size, age and breeding and are fattened in large flocks more successfully.

RATIONS FOR FATTENING SHEEP.

The rations to be fed to fattening sheep will depend upon the season of the year and the size and character of the sheep to be fed. If the sheep are purchased early in the fall it is customary to run them on good pasture until winter, and in this way a considerable gain can be secured usually at a very small cost. In many sections of the State sheep feeders have planted cowpeas in the corn at the last cultivation, and have turned the sheep or lambs into the corn field during the latter part of September to eat off the undergrowth. Lambs will not injure the corn, but other sheep will gradually learn to eat the corn from the hill, and indeed this is a profitable method of fattening yearlings and wethers. Lambs are not to be recommended for feeding off the corn on the hill, although they are highly satisfactory for cleaning up the undergrowth planted as above directed.

RAPE AND COWPEAS IN THE CORN FIELD.

In planting cowpeas in the corn two methods are common. By one method the farmer sows broadcast a bushel of New Era or Whippoorwill cowpeas per acre and depends upon the last cultivation to cover them. Another, and perhaps better method is to drill in one-half bushel of seed per acre between the corn rows at the last cultivation. For this purpose a one-horse drill is used. One acre of good undergrowth will fatten from five to ten lambs per acre. One Missouri farmer fattened 177 lambs and 136 yearling wethers on 35 acres of undergrowth in corn. They gained 27 pounds each in sixty days. In addition to the undergrowth they consumed 25 bushels of corn.

Rape may likewise be sown in corn at the last cultivation, but it requires richer land than does cowpeas. The cowpeas should all be eaten off before frost, but the rape may be utilized until cold weather. It is not good practice to feed lambs or older sheep on green undergrowth and change suddenly to a dry ration. It is best to sell them direct from the corn field. It is, however, good practice to feed corn during the last two or three weeks while they are still eating the undergrowth. This corn may be fed as ear corn scattered widely on the blue grass pasture.

WINTER RATIONS FOR FATTENING SHEEP AND LAMBS.

From Table I on page 371, it will be seen that sheep require more roughage in proportion to the grain consumed than do cattle. The successful fattening of sheep will be more certain to result in profit if a nitrogenous roughness is available. Either clover, alfalfa, cowpea or soybean hay with shelled corn is an ideal ration for fattening lambs, yearlings, or wethers. A large number of experiments conducted at many different experiment stations in the United States where such a ration has been fed have shown this to be one of the most efficient and profitable combinations available in the corn belt.

CORN AND CLOVER HAY.

No one ration has given such uniformly satisfactory results for fattening lambs as a ration of corn and clover hay. The following table gives the results from feeding this ration at a number of different experiment stations:

TABLE IV.

CORN FOR FATTENING SHEEP AND LAMBS.

Station.	Days fed.	Daily gain. lbs.	Feed per 100 lbs. gain.		Remarks.
			Corn. lbs.	Hay. lbs.	
Michigan	105	.31	481	334	10 lambs.
Michigan	105	.24	607	387	10 lambs.
Michigan	91	.26	518	490	10 lambs.
Michigan	91	.307	451	383	Stover.
Wisconsin	56	.37	411	277	5 lambs.
Minnesota	84	.25	523	402	10 lambs.
Iowa	110	.45	302	400	Clover hay, Wethers
Nebraska	98	.38	353	454	Alfalfa.
Wyoming	100	....	236	457	Alfalfa.
Colorado	98	.29	229	988	Alfalfa
Average	....	....	420	458	

The figures show that corn and clover hay without the addition of any other supplementary feed is a very satisfactory ration for fattening lambs. It is, however, true that rations may be compounded which will produce larger gains and somewhat better results than corn and clover hay, but these results are often secured at a higher cost and are, therefore, not as profitable as are the gains made from corn and clover hay.

FATTENING SHEEP ON RATIONS OF GRAIN WITH ROOTS AND SILAGE.

The English shepherd prizes roots above all other feeds for the successful fattening of sheep and lambs. Roots are not widely grown in America, but are exceedingly desirable in all rations for fattening sheep. Silage is more often fed in the United States than are roots. The following table will give in a condensed form the principal results from feeding roots and silage with grain to sheep at the American Experiment Stations. From table 5 it will be seen that the amount of grain (370 pounds) for each 100 pounds of gain is comparatively small, and in this respect rations containing roots or silage appear to be able to reduce, to some extent, the grain requirements for finishing sheep:

TABLE V.

FATTENING SHEEP ON RATIONS OF GRAIN WITH ROOTS AND SILAGE.

Station.	Days fed.	Daily gain, lbs.	Grain, lbs.	Feed per 100 lbs. gain.		Remarks.
				Hay. lbs.	Roots. lbs.	
Michigan	91	.43	233	233	1,101	Oats and bran, 2:1. sugar beets.
Michigan	91	.36	282	225	1,266	Oats and bran, 2:1. silage.
Michigan	105	.24	398	413	2,277	Oats and bran, 1:1. rutabagas.
Michigan	105	.24	400	337	1,383	Oats and bran, 1:1. silage.
Colorado		.31	229	779	1,613	Corn, alfalfa, sugar beets.
Michigan		.37	400	380	270	Corn, roots, clover hay.
Michigan		.31	518	447	317	Oats, roots, clover hay.
Michigan		.38	406	243	700	Corn, roots, clover hay.
Average			370	382	991	

FATTENING SHEEP ON BALANCED RATIONS.

A large number of stations have fed balanced rations to sheep and the results indicate clearly that so far as the grain requirement per 100 pounds of gain is concerned, balanced rations result in a considerable saving. It is likewise true that in feeding balanced rations there is always less risk, the animals maintaining a better appetite throughout the fattening period, and where a balanced ration may be fed at the same cost per pound of gain it is in all cases recommended that balanced rations be fed. The facts are that it is seldom possible to feed a balanced ration at the same cost as a ration of corn and clover hay. It is, therefore, often less profitable to feed a well balanced ration than one like corn and clover hay that is not narrow enough in its composition to be called a well balanced ration, but is nevertheless sufficiently effective to produce good results and at a cost cheaper than would be required to supply the narrower ration. Table 6 will show the results from several Experiment Stations from feeding well balanced rations:

TABLE VI.

FATTENING SHEEP ON BALANCED RATIONS.

Station.	Days fed.	Daily gain, lbs.	Feed per 100 lbs. gain. Grain, lbs.	Feed per 100 lbs. gain. Hay, lbs.	Remarks.
Wyoming	95	.253	320	428	Corn, oilcake and wild hay.
Wyoming	95	.324	240	441	Alfalfa, corn and oil cake.
Iowa	56	.457	345	423	Speltz, bran and clover hay.
Iowa	56	.407	350	473	Corn, gluten feed, bran and clover hay.
Iowa	56	.454	321	421	Corn, bran and clover hay.
Michigan		.34	486	324	Corn, oilmeal, and clover hay.
Average			326	422	

YEARLING SHROPSHIRE WETHERS.

Bred and fed by the Department of Animal Husbandry, University of Missouri.

FATTENING SHEEP ON GRAIN AND PASTURE.

In many sections of the middle west fattening cattle on blue grass pasture is almost the universal method of finishing. In such cases a full ration of grain is fed to animals while on pasture in the summer. This method of fattening sheep is not so common, but that it is worthy of greater development in our systems of farm management will be readily admitted after an examination of the following table. It will be observed that as an average of many investigations at different Experiment Stations the amount of grain required to make a pound of gain by this method is smaller than by any other method of feeding recorded in any of the above tables. In some cases the grain requirement has been only 170 pounds of grain per 100 pounds of gain, and the average for all the investigations is only 245 pounds of grain per 100 pounds of grain as compared with 326 pounds for sheep on a balanced ration; 370 pounds for sheep on grain rations with roots and silage, and 420 pounds for sheep receiving a ration of corn and clover hay. This favorable showing means that where pasture is available sheep may be successfully finished on a much smaller amount of grain than is necessary when fed in dry lots and in the winter season:

TABLE VII.

FATTENING SHEEP ON GRAIN AND PASTURE.

Station.	Days fed.	Daily gain, lbs.	Grain per 100 lbs. gain, lbs.	Remarks.
Iowa	63	.46	170	Lambs on blue grass.
Iowa	56	.45	241	Wethers on grass and rape.
Iowa	56	.41	301	Wethers on blue grass.
Wisconsin	25	.37	170	Lambs on rape.
Wisconsin	70	.28	340	Lambs on rape.
Iowa	63	.46	170	Yearlings, corn and blue grass.
Iowa	63	.42	187.5	Yearlings, oats and blue grass.
Iowa	63	.39	199	Yearlings, barley and blue grass.
Iowa	63	.435	204	Yearlings, corn, oats and blue grass.
South Dakota	42	.44	390	Yearling ewes, corn and grass.
Iowa	56	.453	260	Yearlings, corn, bran and grass and rape.
Iowa	56	.409	312	Yearlings, corn, bran and grass.
Average			245.4	

FATTENING WETHERS AT THE MISSOURI EXPERIMENT STATION.

It is estimated that 80 per cent of the sheep sold on the Chicago market are lambs. The remaining 20 per cent are largely wethers and ewes. The process of fattening wethers is not materially different from that for fattening lambs, but in general it is true that wethers are better adapted for feeding off corn on the hill and will under winter feeding conditions fatten in a somewhat shorter time than lambs. It is also true that wethers require a larger amount of grain for each pound of gain. The Missouri Experiment Station in 1906-07 conducted an experiment in fattening wethers, the results of which are given in the following table:

TABLE VIII.

VARIOUS RATIONS FOR FATTENING YEARLING WETHERS.

Feeding period, 14 weeks. (20 Wethers in each lot.)

Lot.	Ration.	Total Grain, lbs.	Total Hay, lbs.	Total Gain, lbs.	Average daily gain, lbs	Grain for one lb. gain, lbs.	Cost of one lb. gain.	Selling price.
1	Corn and timothy hay.....	2,296	2,608	418	.21	5.4	$0.069	$6.15
2	Corn and clover hay......	2,425	3,131	462	.23	5.2	0.070	6.35
3	Corn, oilmeal and clover hay..................	2,420	3,314	495	.25	4.9	0.070	6.35
4	Corn, cottonseed meal and clover hay...........	2,389	3,409	475	.24	5.0	0.076	6.35
5	Corn, corn silage and clover hay..................	2,429	2,498	533	.27	4.5	0.059	6.35
6	Corn and clover hay (self feed).................	2,988	2,501	481	.24	6.2	0.069	6.40
7	Corn and clover hay (outdoors)...............	2,419	3,339	392	.20	6.1	0.085	6.20

SOUTHDOWN SHROPSHIRE PURE BRED FAT WETHERS.
Fed by the Department of Animal Husbandry, University of Missouri.

In estimating the cost of production the following prices for feed were used: Corn, 39 cents a bushel; timothy hay, $10.00 a ton; clover hay, $10.00 a ton; oil meal, $25.00 a ton; cottonseed meal, $25.00 a ton, and corn silage, $2.50 a ton. The results of this experiment may be stated briefly as follows:

1. The largest gains were made by lot 5, receiving corn, corn silage and clover hay. The next largest gains by lot 3, receiving corn 6 parts, oilmeal 1 part, and clover hay.
2. The smallest gains were made by lot 7, receiving corn and clover hay, and fed out of doors without shelter, and by lot 1, receiving corn and timothy hay, fed in the barn.
3. Lot 5, receiving corn, corn silage and clover hay made the largest gains for the grain consumed. The next most efficient lot in this respect being lot 3, receiving corn, oilmeal and clover hay, followed closely by lot 4, receiving corn, cottonseed meal and clover hay, and lot 2, receiving corn and clover hay in the barn.
4. The lots requiring the largest amounts of grain for 1 pound of gain were lots 6, receiving corn and hay (self feed), and lot 7, on corn and clover hay fed out of doors without shelter.
5. Feeding out of doors without shelter is not to be recommended in Missouri.
6. The smallest amount of hay was consumed by lot 6, receiving corn and clover hay. (Self feed.)

PREPARATION OF DIPPING COMPOUNDS.

Lime and Sulphur Dip.

Lime and sulphur dip has been recommended by the United States Department of Agriculture for ticks, lice, and especially scab. It is prepared as follows:

Unslacked lime	8 to 11 pounds
Flower of Sulphur.	24 to 33 pounds
Water	100 gallons

Slack the lime to a paste. Add sulphur and mix carefully. Add to this mixture 25 gallons of water and boil two hours. Allow the liquid to settle and draw off the clear, brown fluid from the top. Add 75 gallons of water and heat to 104 to 112 degrees. Be sure and keep the dip at this temperature while dipping the sheep.

THE TOBACCO AND SULPHUR DIP.

Soak 16 pounds tobacco leaves or stems in warm water for 24 hours. Put it in 30 gallons of water. Boil for 20 minutes;

strain off the infusion. Mix the same number of pounds of flower of sulphur in water sufficient to make a liquid of creamy consistency. Pour this into the tobacco infusion, stirring thoroughly, and add enough warm water to make 100 gallons. This dip is effective but somewhat troublesome and expensive to make. Care should be taken to keep the animals housed until the fleeces are thoroughly dry.

BOOKS AND BULLETINS ON SHEEP HUSBANDRY.

Books:

"Sheep Farming in America," by Jos. E. Wing.
"The Domestic Sheep," by Henry Stewart.
"Modern Sheep, Breeds and Management," by "Shepherd Boy."

Bulletins:

Illinois Experiment Station: Circular 125, Bulletin 129.
Wisconsin Experiment Station: Bulletin 95, Annual Reports 1893 and 1905.
Nebraska Experiment Station: Bulletins 66 and 71.
Colorado Experiment Station: Bulletins 38 and 52.
Minnesota Experiment Station: Bulletins 31, 57, 59, 75 and 78.
Ohio Experiment Station: Bulletins 117 and 187.
Iowa Experiment Station: Bulletins 33, 35 and 63.
Michigan Experiment Station: Bulletins 84, 107, 113, 114, 128.
Farmers' Bulletins, U. S. Department of Agriculture, Washington D. C. Bulletins 22, 49, 96, 98, 117, 119, 159, 162, 224, 226, 267.
Missouri State Board of Agriculture Reports 1906, 1907 and 1908. Bulletin, "Parasitic Diseases of Sheep."

Acknowledgments:

I am indebted to Chester G. Starr, an advanced student in the Department of Animal Husbandry, for the data recorded in several of the tables accompanying this article.—*The Author.*

THE WINTER LAMB.*

(By E. A. Trowbridge, Instructor in Animal Husbandry, University of Missouri.)

The term "Winter Lamb" or "Hot House Lamb," refers to a lamb that is in condition to go on the market between January 1 and the advent of warm weather, as a prime young lamb, weighing from sixty to eighty pounds, alive. He differs from the ordinary lamb in that he is ready for market in the early spring, only twelve to sixteen weeks old, and is still possessed of his lamb fat and form, while the ordinary lamb sold in the fall is five to eight months old, and his condition has changed from that of a lamb to that of an older sheep.

The business of winter lamb production may well be classed as one of the highly specialized branches of modern farming. It demands the closest attention to all details, and without such attention success is not attainable. The profits resulting from the successful production of winter lambs are quite enough to compensate for the extra attention it requires.

THE WINTER LAMB.
Courtesy Wisconsin Experiment Station.

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*From Monthly Bulletin State Board of Agriculture.

THE MARKET AND PRICES.

This branch of the sheep industry is very profitable, if successfully managed, because of the high selling price of the lambs and the early age at which they go to market. As has been stated, they go to market at twelve to sixteen weeks old, fat from their mother's milk, and sell at prices ranging as high as $10.00 per lamb, although by no means do they all bring that price. The price is determined by the demand and the quality and condition of the lamb.

The demand for winter lambs "opens up after the people have recovered from the poultry glut of the holidays," according to Mr. H. P. Miller, a man who has made a success of the business. It comes from a wealthier class of people, consequently the high prices which are paid. The demand is only a limited one, but as the supply is comparatively light, the market is not usually oversupplied. Until the present time, the winter lamb has been eaten more in the east than in the west, but the demand for spring lambs in our central west cities is increasing.

Spring lambs are usually sold through commission firms, whose duty and business it is to keep the producer informed a few days ahead as to how many lambs he can find sale for at a given time, generally the last of each week. They are shipped usually by express in lots of from two to twelve, according to the demand. The frequent shipping of only a few lambs at one time gives opportunity for the shipment of lambs just at the time when they are ready for market.

PREPARATION FOR MARKET.

The lambs are slaughtered and dressed by the producer and the carcasses made as attractive as possible before shipping. Mr. H. P. Miller says, "The preparation for market requires some skill, yet only such as almost anyone can develop after carefully studying directions. It is very important in slaughtering to have the lambs thoroughly bled out." In dressing lambs for market, the head is taken off and the entrails removed, the carcass cleaned and made to appear as attractive as possible. The hide is left on the carcass. Carcasses should be allowed to hang in a cool place for twelve to twenty-four hours to chill before shipping them. For shipping, each carcass is neatly sewed in a square piece of muslin of suitable size, after which it is packed in a crate, sometimes by itself, but more frequently with several more, and consigned to the commission merchant.

BREEDING STOCK.

The ewes that can be profitably utilized in the production of winter lambs are those ewes that will drop their lambs in November or December; those that will produce a large percentage of twins, and those that will give an ample quantity of milk to nourish their young. In order to drop lambs at the above-mentioned date, it is necessary that ewes be mated with the ram during May, June or July. At the Wisconsin Experiment Station some difficulty was experienced in getting ewes to mate at this time. This has been found to be the case in many instances, but the Dorset or Grade Dorset ewe is particularly adaptable to this scheme of lamb production. Ewes of this breed are also excellent milkers, and bear a large percentage of twins. It may, then, be said that Dorset or Grade Dorset ewes stand out preeminently as early lamb producers. Merino ewes are reported as fairly adaptable to such early matings.

Some producers of winter lambs mate the Dorset or Grade Dorset ewes with a ram of the same breed, but the majority of successful men in the business prefer a ram of some of the Down breeds—Shropshire, Hampshire, Southdown or Oxford. In selecting a ram much stress is laid upon early maturity, thickness of flesh, constitution, vigor and quality. In other words, a good type of modern mutton producing ram is used for the production of winter lambs.

MATING AND CARE OF THE FLOCK.

Even with Dorsett ewes difficulty is experienced in attempting to mate them in the warmest months of the year. It is natural for sheep to mate during the fall when the weather is cool, thus to successfully mate ewes at any other season, conditions as near like those of October and November must be supplied.

In a small volume entitled "The Winter Lamb," published by that veteran sheepman, Joseph E. Wing, the following rules for mating ewes for fall lambs are laid down:

"First—Have ram with ewes not earlier than middle of March, not later than the middle of May.

Second—Put the ram with ewes nights, not days.

Third—Use young ram and feed him well while in service.

Fourth—Do not have ram too fat.

Fifth—Do not have ewes too thin.

Sixth—If ewes are not shorn in fall, shear as early as you dare.

Seventh—Feed ewes green food, such as ensilage, turnips, carrots, mangels, etc., with some corn."

After the ewe has gotten with lamb her care during pregnancy, which is during the summer months, is comparatively simple. Good pasture is essential, and this may be supplied by clover, alfalfa, blue grass or forage crops of some sort. A pasture of any of these will furnish ample feed, but here, as with the ordinary flock there is danger of parasitic troubles. This is with all sheep best avoided by frequent change of pasture. Good, pure water is a requisite best supplied by clean watering troughs filled from an underground source, or a reservoir, which has not been subject to contamination. Shade must be supplied, but whether it be trees or shed, the ground beneath it should be frequently disinfected to prevent the development of parasites, which are sure to be present where sheep spend so much time as they naturally do during summer under shade of any kind.

LAMBING TIME.

Ewes do not need grain before lambing if good pasture is available. They should approach their parturition in strong and healthy condition, but not too fat. This care should be similar to that of any ewe at lambing time. She should be given a pen to herself. Close attention on the part of the shepherd is essential, yet ewes at this time should be alone, unless they need help. Assistance should be given only after unsuccessful attempts on the part of the ewe to give birth to her offspring, and, when necessary, no time should be lost in administering aid. After lambing, the ewe's udder should be watched closely, and any milk not taken by the lamb should be hand drawn to prevent udder trouble.

CARE OF LAMBS.

The care of fall lambs does not greatly differ from that of other lambs. Mother and offspring should be kept by themselves until the lamb is strong enough to be turned with the other ewes and lambs. The object is to grow and fatten these lambs as rapidly as possible, consequently they should have a grain ration as soon as they will eat. A satisfactory grain ration consists of oats, corn and bran, one-third each, by weight, the oats being crushed and corn being ground. This should be fed by building a lamb creep in which the grain is placed. A creep may be made by fastening upright boards six or eight inches apart, as a partition between two pens so as to admit the lambs, but not the ewes. While the lambs are on pasture during the day they will eat only very small amount of hay, but as soon as they are "kept up" they will consume considerable hay. This hay should always be clean and well cured. It best consists of some leguminous crop, and lambs must not be expected to eat the coarser stems. Both grain and hay should be changed frequently, so that no sour feed is ever found in the troughs. Fall lambs should never be left out of doors through the cold storms of early winter if proper gains are expected. They should be supplied with all the comforts possible in the way of food, water, shelter and attention, and if these are given the results will be satisfactory and the remuneration profitable.

(Courtesy "The Feather.")

YEARLING FORTY POUND BRONZE TOM.

POULTRY PROBLEMS AND PROFITS.

(W. L. Nelson.)

Nature did much towards making Missouri the first State in the Union in point of poultry production. The people are doing their part, hence the place of pre-eminence which the State now proudly occupies.

Nowhere can poultry be raised with more profit or less labor than here in Missouri, where are thousands of sunny slopes and sun-kissed hills, making for the hen a happy home; where sunshine and shade are present in the most pleasing proportions; where water, clear as crystal, bubbles forth in abundance; where, from a fertile soil, grow grains and grasses such as the man in the business too often has to buy; where are no long wet seasons, conducive to disease, nor months of extreme and continued cold, to make expensive housing necessary and to double feed bills; where come no long periods of excessive heat and devastating drouth; where poultry production may be profitably combined with general agriculture and especially with fruit and dairy farming; where transportation facilities are ample, and where large cities afford the best of markets throughout the year.

The many millions of dollars' worth of poultry produced annually in Missouri comes almost exclusively from the farms, where such as is sold represents clear profit—and more, for the eggs and poultry consumed on the table more than pay the cost of keep. The Missouri farm without poultry is the exception. In eight years the value of the surplus of poultry, eggs and feathers produced in Missouri has more than tripled. With better methods have come larger returns. Many who once "kept poultry" are now letting poultry keep them. There is both pleasure and profit in poultry production, and the more profit the more pleasure.

The State Labor Bureau places the value of Missouri's surplus poultry products for the years 1900 to 1907, inclusive, at $214,527,835. For the year 1907 alone the value of the State's surplus farmyard products—live poultry, dressed poultry, eggs and feathers—figures $44,866,447. So great are these figures that only by comparison may they be fully comprehended.

The value of Missouri's surplus farmyard products for a single year is almost three times as great as the price paid for all that vast territory represented by the Louisiana Purchase, and of which Missouri is a part.

The 1,388,742 head of cattle marketed by Missouri stockmen in 1907 did not bring as much by a few thousand dollars as did the surplus poultry products of the State for the same period. Yet, Missouri is a great cattle State.

The 3,878,863 head of hogs and the 817,430 head of sheep, representing Missouri's surplus pork and mutton producers for the year 1907, did not equal in value her farmyard products sold the same year. Yet, Missouri is a great hog and sheep State.

All the surplus mine, quarry, stone and clay products mined, quarried or manufactured in Missouri during the year 1907 did not foot up as many dollars as was represented by the surplus poultry products for that year. Yet, Missouri is a great mining State.

During the year 1907 Missouri produced 23,929,332 surplus bushels of wheat, but it brought less than half as much as did the poultry, eggs and feathers sold during the same twelve months. Yet, Missouri is a great wheat State.

The estimated yield of corn in Missouri during the year 1907 was placed at 232,541,324 bushels, worth $103,561,401, but large as are these figures, they are less than two and one-half times as great as the surplus—not the total—poultry products for the same period. Yet, Missouri is a great corn State.

If the surplus eggs produced in Missouri during the year 1907 were laid in a row, end to end, they would extend more than twice around the earth.

Pre-eminent as is Missouri's place in commercial poultry production, her fame is not alone confined to this field. Her breeders of pure-bred birds have won high honors in the leading shows of the land. To a Missouri breeder belongs the distinction of having raised the highest priced pen of chickens ever sold. Here, too, is the home of what is said to be the highest priced hen in the world. Birds of the various breeds sometimes sell for hundreds of dollars each, and a few have reached the four-figure mark. In Missouri there seems to be that "something"—it may be the climate, which has much to do with constitution—that gives to the fancy bird, intelligently cared for, a near approach to perfection.

The large number of pure-bred birds in Missouri is helping to give to the State a reputation for the high quality and unsurpassed excellence of its poultry and eggs, so that in every market frequented by discriminating buyers the State's farmyard products find favor.

For either the fancier or the producer of commercial poultry there is no state that offers better advantages than does Missouri. The man who is looking for cheap land, suitable for poultry farming on a small scale, can here find just what he wants. But the opportunities are not limited to the small operator who seeks a home in the country where health and happiness may be his. There are, near the larger cities or on railroads leading thereto, many places where large poultry plants may be operated with profit. Great as has been the increase in output, it has been exceeded by the increased demand, and there seems to be no reason why overproduction should be feared.

WHITE HOLLAND TURKEY POSING FOR A PICTURE.

There is health and wealth in the egg basket, as many Missourians now know. The figures which so eloquently tell the story of the State's lead in the output of farmyard products are large, but think what they would be should Missouri farmers give to this branch of their business as much attention as is given to other, and often lesser, lines.

HISTORY AND CLASSIFICATION.

Most writers on poultry subjects claim that our chickens were in all probability domesticated at a very early period from the original jungle fowl, the *Gallas Banciva,* native in southwestern Asia and Oceanica. Turkeys are native to America. Guinea fowls came originally from Africa. Pheasants originated in Asia. Pigeons used for food have been developed from the wild blue rock dove. It is believed that most of our domesticated breeds of ducks were derived from the wild Mallard. Geese, common the world over, have been used as table birds since ancient times.

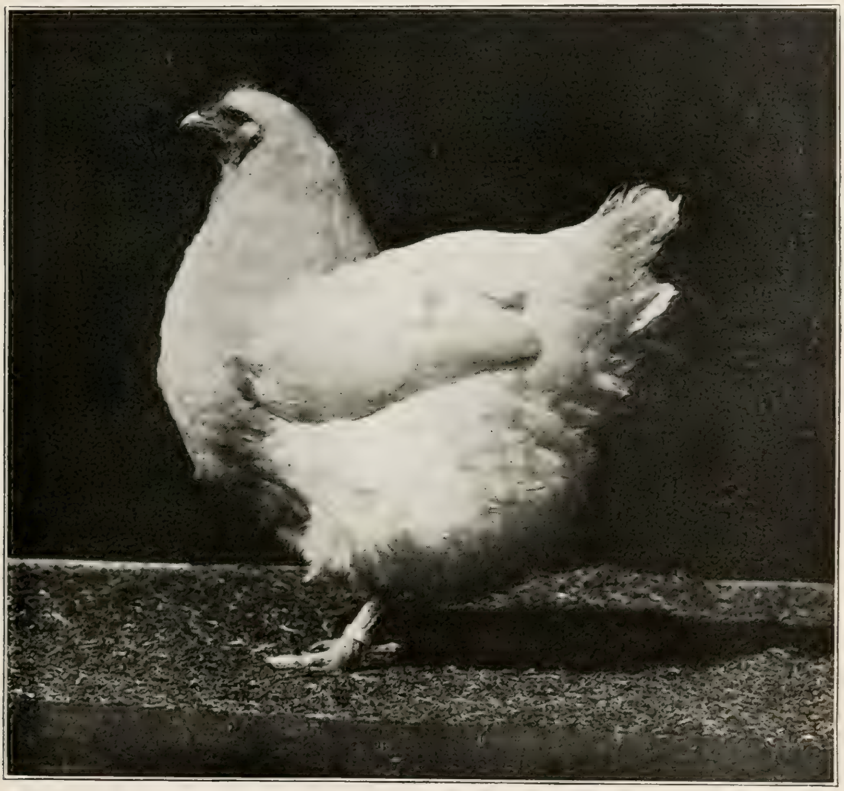
Standard Varieties of Chickens—Farmers' Bulletin No. 51, United States Department of Agriculture, by George E. Howard, names 104 standard varieties of chickens, as follows:

1. American class: Barred, White and Buff Plymouth Rocks; Silver, Golden, White, Buff, Black, Partridge, Silver-penciled, and Columbian Wyandottes; Black and Mottled Javas; Rose-comb Dominiques; Single-comb and Rose-comb Rhode Island Reds, and Pea-comb Buckeyes.
2. Asiatic class: Light and Dark Brahmas; Buff, Partridge, White, and Black Cochins; Black and White Langshans.
3. Mediterranean class: Single-comb Brown, Rose-comb Brown, Single-comb White, Rose-comb White, Single-comb Buff, Rose-comb Buff, Single-comb Black, White Duckwing Leghorns, Single-comb Black, Rose-comb Black, and Single-comb White Minorcas; White-faced Black Spanish; Blue Andalusians, and Mottled Anconas.
4. English class: White, Silver Gray, and Colored Dorkings; Rose-comb Redcaps; Single-comb Buff, Single-comb Black, and Single-comb White Orpingtons.
5. Polish class: White-crested Black, Bearded Golden, Bearded Silver, Bearded White, Buff-laced, Non-bearded Golden, Non-bearded Silver, and Non-bearded White Polish.
6. Dutch class: Golden-spangled, Silver-spangled, Golden-penciled, Silver-penciled, White, and Black Hamburgs.
7. French class: Mottled Houdans, Black Crevecoeurs, and Black La Fleche.
8. Game and Game Bantam class: Black-breasted Red, Brown Red, Golden Duckwing, Silver Duckwing, Red Pyle, White, Black and Birchen Games; the same varieties for Game Bantams.

9. Oriental Game Bantam class: Cornish and White Indians, Black Sumatras, Black-breasted Red Malays, and Black-breasted Red Malay Bantams.

10. Ornamental Bantam class: Golden and Silver Sebrights; Rose-comb White and Rose-comb Black; Booted White; Light and Dark Brahmas; Buff, Partridge, White, and Black Cochins; Black-tailed, White, and Black Japanese; Bearded White, Buff-laced, and Non-bearded Polish.

11. Miscellaneous class: White Silkies, White Sultans, and Frizzles.



A WHITE BEAUTY—A MISSOURI BRED BIRD.

Common Classification—

The eleven classes of chickens may, for practical purposes, be grouped into four general classes, as follows: The egg breeds, the meat breeds, the general-purpose breeds, and the ornamental breeds. In the European or Mediterranean classes are found our non-sitting and greatest egg-producing birds. They are smaller, light-feathered, quicker maturing, have a greater egg-producing capacity, are less disposed to become broody, and are more active than the Asiatic fowl. On account of large wattles and combs they are somewhat sensitive to low temperature. The Asiatic fowls include the large meat breeds. They are easily confined by low fences, and are persistent sitters. The American breeds are included in the general-purpose list. They represent a "dual purpose" type, being adapted to those who wish a supply of both eggs and meat. They are usually good sitters and "occupy a medium position between the egg and meat breeds as to size, egg production and docility." The ornamental breeds are popular with fanciers and others, but "are not so well adapted for farm purposes as are breeds of the other three classes."

THE BUSINESS AND THE BEGINNER.

It has been well said that "in the poultry business, as in other callings, the highest success must come from the largest ability and most unceasing labor." Eternal vigilance and hustle is the price of success. Poultry raising for profit is not for lazy people, but for the man or woman who is willing to work with a will no other business will pay larger returns upon the investment.

A question often asked by the beginner or one who is about to embark in the business is, "What is the best breed?" In reply, it may be said that, in the common acceptance of the term, there is no best breed. In brief, the best breed is the one we like best. There are, of course, some that are superior for certain purposes. The strain may be of more importance than the breed. For instance, some strains are especially improved for egg production.

In selecting stock be sure that it is strong, vigorous and healthy, and in choosing remember that "a hen carries her health certificate right on the top of her head," the comb point, according to good authorities, being an index to physical vigor. A hen, to be disease resisting, must have stamina and must come from strong stock. According to James E. Rice, of Cornell, "Weak parents produce weak eggs. Weak eggs develop into weak chicks. There must be health, vigor and vitality at the start. There is a great difference in the natural vitality of different flocks of chickens of the same breed and variety. Some are big and lusty, others are weak and sickly—constitutionally so—through inheritance. Their parents were either weak naturally or became so through improper care." The success of the average poultryman will depend in large measure upon his ability to maintain and add to the vigor of his flock.

The beginner will soon find that he cannot follow all the suggestions of the theoretical poultry fancier. He may also find that set rules are not always a sufficient guide—that there are some things learned only by experience. Some, by following fads too far, have met with failure. There is danger that in breeding for unusual excellence in some one particular, other and more important points may be neglected.

The following paragraphs are contributed by some experienced poultry raisers in Missouri.

CHICKENS ON A MISSOURI FARM.

"The way to start in the business is to build one good poultry house with a scratching shed attached, and two small colony houses, 6 by 10 feet. These should be light so as to be easily moved. With these in good shape, poultry raising is a pleasure, and no stock on the farm will bring in more cash. There will be no store bills to pay when the wheat or stock is sold, and cash will be coming in every week in the year. Then when the large, glossy thoroughbred turkeys are sold a nice piece of furniture or a fine carpet may be bought without drawing on the bank account. So, Mr. Farmer, it is much to your interest to help just a little with the poultry. Chickens need to be fed and cared for as well as other stock. It is a very poor farmer's wife who doesn't enjoy taking up a neat egg basket every evening and gathering up nice clean eggs."—Mrs. H. R. Schlotzhauer.

"In the poultry business procrastination is the thief of success. Success depends largely upon not neglecting the small things that are so important—the sanitary conditions, the proper housing of the fowls, and the necessary feed."—Jess L. Miller.

"First regulate the classes and numbers of your fowls in strict harmony with the size and capacity of your farm and home. Keep in mind the fact that poultry, and especially chickens, are hearty feeders and require much nourishment. Especially is this true of young chickens, which should receive careful attention and good wholesome food. I have noticed on farms that a large per cent of chicks perish for want of nourishment suited to their age. Lack of proper care and the use of improper food subtracts larger numbers than do all the diseases of the poultry yard. Our best success comes from keeping the chickens, ducks, turkeys and other domestic fowls moving at a high pressure rate during the early weeks and months of their growth. This treatment will perfect fine birds, which will sell for profitable prices. If you don't expect to give your poultry good care and proper food, don't go into the business. Having the confidence of all your birds is of much value. Keep out sources of annoyance—boys and dogs. Don't alarm your live stock of any kind. 'Fear worketh ferment,' is a Bible maxim." —Jasper Blines.

"Poultry raising is not different from other callings, and failures are usually traced to not knowing or failing to attend to the necessary details. Success follows knowledge just as surely as failure hangs on ignorance. Unfortunately, the knowledge necessary to successful poultry production is harder to obtain than in most other occupations. It has to come largely from personal experience. In most other callings there are certain accepted principles which are well understood. There are no known rules which will always produce like results in poultry production, yet success is pretty certain to follow, if stated principles are carried out. The wise beginner is one, who, having determined to enter the ranks, is willing to put in long hours all the year, be content with fair wages and keep 'everlastingly at it.' Then results will follow."—Mrs. W. B. McCord.

"If one has a natural taste for the occupation, is willing to work (every day in the year) and pay attention to details, there is pleasure and profit in poultry raising, but if not attended to properly, better keep out of it as a business proposition."—Miss A. Sargent.

VALUE OF PURE-BRED BIRDS.

There is no more reason why the man in the poultry business should raise birds of poor quality than should the farmer raise scrub cattle, sheep or hogs. If it pays to raise pure-bred live stock of one kind, why not of all? The poultryman who raises beautiful birds, in which he takes pride, will get more profit and more pleasure out of his work than does the man who is satisfied with scrubs. There is value in uniformity. The attractiveness of the flock on the farm often aids in making sales. Another advantage of having a flock of uniform kind and color comes in the marketing of commercial poultry and eggs. We must have pure-bred fowls in order to insure uniformity in color, shape and size of eggs. It is also a decided advantage, when marketing dressed poultry, to have all uniform in size, color and conformation.

"If all farmers in Missouri knew the value of a pure strain of fowls there never would be a mixed bunch of mongrel poultry to be found in the limits of the State. A little experience of mine will illustrate the point. I culled out of my flock of pure-bred birds, last year, one hundred head of cockerels that were unfit for breeding purposes, and sold them to a local dealer here at an advance of one and one-half cents per pound over the market price." —Gus L. Hainline.

"I am convinced from my experience that it does not cost as much to raise thoroughbred poultry as it does the common stock. It takes longer to mature the common stock, which means more feed, hence more cost."—Harry Sloan.

"I have been engaged in the poultry and produce business in this county for five years, and have noticed with interest the improvement in quality. I have on every occasion that I could, during these five years, encouraged the farmers and poultry raisers to get the better breeds of poultry, explaining to them how they could raise and keep hens that weigh six to eight pounds as easily and as cheaply as they could keep scrubs weighing only three or four pounds each."—Elmer L. Finch.

INCUBATION.

There are two methods of incubation—natural and artificial. The success of either depends, first, upon the egg itself. Neither hen nor incubator can hatch an infertile egg. In mating birds one male should be allowed to from twelve to twenty hens, depending upon the breeds, also upon other conditions. The fertility of eggs depends, too, upon the health and vigor of the flock, and to some extent upon the feed and care. Eggs for hatching should be kept at a temperature of from 40 to 70 degrees Fahrenheit. Eggs of standard size, rather than very large or extremely small, should be selected, and the best results may be expected when all the eggs are of the same kind.

"The whole theory of incubation is based upon the fact that if a fertile egg is kept for a sufficient period of time under certain conditions of heat, moisture and position, it will be transformed into a healthy fowl."

The periods of incubation recognized as approximately correct are as follows: Common hen, 21 days; pheasant, 25 days; common duck, 28 days; peafowl, 28 days; guinea, 25 days; goose, 30 days; Barbary duck, 30 days; turkey 28 days.

Those who adhere to the old, and generally sure and safe, method of hatching eggs under the hen, may find it a good plan to have two hens bring off their broods at the same time, then give all the chicks to one hen. From twelve to sixteen eggs are generally placed under a hen, the number depending upon the size of the hen, the kind of eggs, and the time of year, it being safe to give a hen more eggs to cover when the weather is very warm than when it is cool. Chicks hatched by the natural process are generally strong, but are in more danger from vermin, unless the hens and their surroundings are carefully looked after.

With the use of incubators constantly becoming more common, the subject of artificial incubation is one of interest to a very large per cent of the people. "The incubator," some one has said. "was the first nature fakir." To this it might be added that it has "made good." The idea of artificial incubation is not new. Artificial egg hatching was practiced before the Christian era. Ancient hatching ovens have recently been unearthed by explorers in Old World ruins.

Dr. Richard H. Wood, in Farmers' Bulletin, No. 236, United States Department of Agriculture, says: "The incubator is an important factor in poultry raising. It is a success; it has come to stay; and the time is not far distant when it will be as necessary upon every farm as is the plow, the mower or the separator."

The incubator is not an improvement upon nature. Nature is not to be improved upon. However, it may be said that artificial incubation has its advantages. The chicks may be hatched early and be ready to market when prices are good. The pullets mature earlier in the fall and commence laying before winter sets in. The hens, when stopped from sitting, may soon commence laying again.

POULTRY HOUSE AT STATE HOSPITAL AT NEVADA, MO.

The kind of incubator is all important. As it has to deal with living products, it should be as near perfect as possible. Buy a good incubator or none at all. Dr. Wood, who is quoted elsewhere in this article, summarizes the good points of an incubator, as follows: "Good material, good workmanship, and adaptability of parts, or such arrangement of the various parts of the machine as shall make it efficient, practical, and convenient, are desirable. Two dead-air spaces, good strong legs, plenty of space in the egg chamber, good windows properly placed, a good thermometer located where it can be read wthout disturbing the machine, are all necessary and among the strong points of a good incubator. In addition to these, there are a good lamp—one with a good burner and a good chimney—a good regulator, a good strong tray properly placed and a good, roomy nursery tray below."

A good incubator having been purchased, the place to put it is next to be considered. The location should be one that is not subject to too great changes of temperature. A cellar, if it is well ventilated (pure air being a necessity) and not too damp, may prove to be a good place. Drafts are to be avoided, nor should the direct rays of the sun be allowed to fall upon the machine, which should stand perfectly level.

Next comes care. The best machine, properly placed, will prove a failure unless carefully cared for. With each machine are complete instructions which should be carefully studied, then followed. The operator should do his experimenting before the eggs are placed in the machine, never after. With this object in view, the machine may be started some time before it is to be filled. Care should be taken to see that the regulator is working perfectly. The eggs should be tested as directed, say at the end of the seventh, tenth and fourteenth days. Do not handle the eggs with greasy hands. Beware of too much heat in the machine. More chickens have been cooked than were ever frozen to death, and more chicks have been hatched in over-heated incubators than were ever raised. Keep the lamp filled and cleaned, having regular hours for the work, and use none but good oil. Finally, remember that "too many cooks spoil the broth." Let one person manage the machine.

Dr. J. H. Casey, in writing on "The Science of Poultry," touches upon incubation as follows:

"Why do chickens die in the shell and fail to come to maturity? By some the lack of moisture is advanced as the sure reason; by others, the variation of the heat in the incubator. Now both may have a show of reason, and yet from the results alone, neither may be right. The study of nature's laws as carried out by the instincts of the hen is the only positive way by which we may learn just what is necessary to obtain success. There are laws which govern this process, and these laws must be copied exactly to get the same results which nature produces. In this we are dealing with the problem of life and the vital questions which produce and sustain it. What are these laws? Heat, as produced by and radiating from the living body and applied in the proper manner. The degree of this heat is stated to be 103 degrees Fahrenheit, as shown by placing a thermometer under a setting hen. But the question arises, is the same degree of heat maintained all the time during natural incubation? And is this amount of heat as radiated from the hen modified or raised by any known cause? Has it been proved that this law as applied by artificial incubation is exactly the same as supplied by nature? Is the knowledge of this law a positive one and its action a scientific fact? Again, take another of nature's laws, moisture. How much of this is supplied by the hen? Has or can this be measured exactly during the entire time of incubation? How much is necessary to obtain the desired results? In what way does this moisture affect the growing chick? Is this law scientifically applied? We know that within the egg nature stores, a certain amount of air for the sustenance of the future bird, and that when the hen leaves the eggs to provide herself with food and water, that air passes through the shell, and carbonic acid gas passes out, but have we as yet determined positively the exact amount of this interchange of gases? A positive knowledge of this may aid us in determining how long we should cool the eggs. As the chick develops in the shell, by a chemical process, carbonic acid gas is formed and by the method of exosmosis, this passes off in the air. Shut up in the incubator it accumulates unless proper exits are provided. Do we keep the air in the incubator as pure as the natural process? Here, again, we need scientific knowledge in order to copy nature."

CARE OF THE CHICKS.

The problem of keeping chicks alive and healthy is one more difficult of solution than is that of how to get a good hatch. It often happens that an unusually fine hatch is followed by the death of a large per cent of the chicks. In fact, chicks of phenomenal hatches seem harder to raise than are those hatched when only average records have been made. Such chicks may seem especially bright and active at first, only to chill, sicken and die later. They are usually sensitive to cold, caused, some authorities contend, by the incubator having been kept too hot, and perhaps too dry. Such chicks may hatch earlier than others, this fact leading the beginner to believe that he has been unusually successful.

Cleanliness and warmth are necessary if the chick is to be kept healthy. Beware of allowing the chick to become chilled. See that its surroundings are conducive to comfort. Keep the brooder clean and free of vermin. Do not crowd the chicks, nor have the brooder too close or too hot. Remember that the chick's instinct teaches it to go toward the heat, rather than from it. Bear in mind, too, that with the little chick, too much dampness means death. In operating a brooder be guided always by the action of the chicks. In this way you can tell whether the brooder is too hot or two cold.

The chick's food for the first day or two is supplied in the yolk of the egg, which is enclosed in the body of the chick a short time before it leaves the shell, so that the chick need be given no food for from twenty-four to forty-eight hours, and some authorities say longer. Do not give the chicks anything that will sour in their stomachs. Do not overfeed, leaving the excess to sour. Many chicks die because of sour, fermenting food, fed in filthy troughs or vessels. The little chicks should always be kept hungry enough to hunt for food, but remember that a little chick, like a little child, needs food often. Weak chicks may be started upon dry bread crumbs moistened with milk. Hard-boiled eggs are also good. After three or four days well-cooked corn bread baked in a pone may be added. A feed that is recommended is to make bread by mixing three parts corn meal, one part wheat bran, one part wheat middlings or flour, with skim milk or water, mixing it very dry and salting as usual for bread. Bake thoroughly and when dry enough to crumble, break up, dry out in oven, and grind in a mortar or mill. Grain cracked in an old coffee mill and sifted through a sieve so that the particles will not be too large makes good chick feed. As the chicks grow older see that they have plenty of grain, meat and green food and pure fresh water.

To prevent bowel trouble in young chicks avoid all sloppy food, and if necessary, take away the drinking water and use scalded milk instead. She so-called white diarrhoea usually attacks the chicks that are constitutionally weak, and seems worse when they are exposed to dampness and cold.

Little chicks need grit, but the use of sharp, flinty grit is condemned, for in the newly hatched chick the tissues are soft. Crushed egg shells are the best grit for all very young chicks.

Some authorities contend that the incubator-hatched chick doesn't know enough to select food until it is eight or ten days old, so may fill up on bran, sawdust or sand. These writers hold to the theory that instinct is not so fully developed in the incubator-hatched chicks as in those that are hatched by the natural method. If this is true it may account for the death of many young chicks, and should serve as a warning against allowing them to have access to such things as may cause their death in this manner.

"My choice chick feed is millet, which I buy in the fall when the farmers are threshing, but don't feed millet without plenty of grit. I take a small box and tack a piece of screen wire over if after the bottom has been removed, making it like an old-style meal sieve. Then I sift my grits, using the fine grit for the little chicks, and saving the larger for the birds in the yards."—Robert Brittain.

TURKEYS GETTING GRASSHOPPERS IN MEADOW.

"Look out for lice. A few of the 'big body lice' will weaken and kill a chick in a short time. To keep chicks free from lice take a very little lard or vaseline and put it on the head and below the wings. Have good dry coops, free from mites and dampness. The cheapest way I know of to keep coops free from lice and mites is to paint them with cheap kerosene."—Dan Oberhellmann.

FEEDS AND FEEDING.

One of the first rules to be observed in feeding is to make the fowls work for all they get, but be sure that they are paid for their work. Scanty rations, grudingly furnished, will never make a thrifty flock. Grains should be fed in light, clean straw. Hens enjoy scratching, but not in damp, filthy litter.

It is said that the average hen will consume about 110 pounds of food per year, and that a flock of fifty hens will drink from one to two gallons of water per day. "Too much stress cannot be placed on the necessity of having good water, as impure water will undoubtedly cause sickness among the poultry. The more green food consumed, the less will be the quantity of water needed."

The feeding of chicks has already been touched upon. A balanced ration is important in the feeding of fowls. By a "balanced ration" is meant one in which the protein and carbohydrates is properly proportioned. Chickens on outside range balance their own rations. All feeding stuff contains three elements to greater or less degree, protein, carbohydrates (including fat) and ash. Protein makes flesh, blood, muscles and tendon. Carbohydrates supply fat, heat and energy. Ash supplies the mineral needed in bone and egg making. The condition of the fowl is always the best guide in making rations. If the birds are getting too fat reduce the carbohydrates (starch, oil, fat of grain, etc.) and increase foods rich in protein. Skimmed milk is a valuable source of animal protein. Study both the food and the fowl. In cold weather, fowls need more fuel nutrition. Laying hens require more protein in order to secrete white of egg, which is a form of protein called albumen. A hen that lays 150 eggs per year will require for egg shell alone, more than 1 1-2 pounds of mineral matter. Wheat, bran, clover and turnips are rich in mineral matter.

Cottage cheese is rich in protein, but poor in fat. Earth worms and grass hoppers contain nearly ten times as much protein as fat. Fowls are grain-eaters and are also fond of meat, so they must have animal food to make a balanced ration if they have not access to soil containing worms, or a range providing bugs and grasshoppers. One pound of fresh cut green bone is sufficient for sixteen hens. Meat meal and fresh meat are good, but too much will cause intestinal trouble. Many a farmer has found his hens have increased in egg laying soon after "hog killing time," the animal matter which they got at that time being just what was needed. Some have found it a good plan to occasionally buy a piece of cheap meat and hang it up where the hens could peck at it. Cabbage or other vegetables may also be fed in the same way, and the more of such food the better. Hens need green food and plenty of it.

The system of dry mash feeding is one that is now generally recommended, especially for laying hens. One authority says, "Feed grain and vegetables, in straw, in morning, making birds work. Then feed warm, easily digested mash at night, for eggs." However, poultrymen are not agreed as to the best time for feeding mash, some favoring it for the morning meal. A good mash may be made of 3 parts bran, 2 parts middlings, 1 part corn meal, 1 part oat meal, ¼ part meat meal, ½ part charcoal and 1 teaspoon salt. Another would be 4 parts shorts, 2 parts alfalfa meal, 1 part corn meal, ¼ part meal meat, ½ part charcoal, 1 teaspoon salt.

Some good balanced rations that have been recommended are as follows:

Five pounds wheat, 4 pounds corn meal, 5 pounds barley, 2 pounds alfalfa, 2 pounds bran, 1 pound meat meal, ½ pound blood meal. If alfalfa is not available use more oil cake or meat meal.

Ten pounds wheat, 4 pounds middlings, 4 pounds bran, 1 pound meat meal, 15 pounds skim milk.

Ten pounds wheat, 3 pounds shorts, 5 pounds corn meal, 2 pounds cottage cheese, 1 pound blood meal.

Hens must have grit. "Grit enables the gizzard to prepare the food for digestion. It is a fowl's false teeth. When grit becomes worn out it is expelled. If the sharp material cannot be secured, the food must remain unground in the gizzard until it softens and falls to pieces."

"Most of the time my poultry has free range, which is always best at all times. When yarded I try to use common sense in feeding, following nature as near as possible, instead of formulas."—Miss A. Sargent.

"I feed wheat, oats, corn, cane seed and sunflower seed. In winter a mash made of bran and alfalfa meal is fed once a day, with an occasional feed of potatoes, beets, cabbage, turnips or and refuse from the house."—F. C. Gibson.

"In winter I feed all kinds of grain that we raise; also green bone, when I have it, and vegetables and milk, with grit and plenty of clean water provided at all times."—Mrs. J. T. Hume.

"For green food use potatoes, timothy, crabgrass, peavines, sweet potato vines, onions, radishes, lettuce, turnips, corn fodder, kaffir fodder, carrots, ripe tomatoes and cow peas, and poor apples and peaches, cooked. For grit, use coarse sand and some oyster shell. A little ground flax seed is good for the birds. I grind it in a hand-mill by mixing a little grain to prevent oil from clogging up the mill."—Elmer Putnam.

"We feed our hens at night on whole corn, and for the morning feed, give them a mixed feed composed of wheat, kaffir corn and cracked corn in parts of ten bushels of wheat, ten bushels of kaffir corn and five hundred pounds of cracked corn, thoroughly mixed. I feed about a quart of this mixed feed to every dozen hens each morning. I feed it in straw or trash. I have a bone cutter and purchase from the butcher shop, at one cent per pound, fresh bones, which I put in the bone cutter and grind, and feed to the chickens about twice each week. I usually purchase about ten or fifteen pounds for seventy five or one hundred hens. We start our little chicks on oat meal, feeding it dry, and by feeding them on this dry oat meal until they are two or three weeks old we prevent any bowel trouble among them. After they become two or three weeks old we feed them baked corn bread, in which some eggs have been stirred before baking, or we feed them meal mixed with boiling water and when they are about three months old we put the feeder out. Our feeder is one that I have made and it did not cost much. I have a partition in it, and on one side I put the whole corn, and in the other side I put the mixed feed of wheat, kaffir corn and cracked corn; I put the feeder in some convenient, shady place and keep fresh water, oyster shells and grit close by. For grit I use finely crushed limestone rock and coarse sand or gravel. In buying grain for feed, I buy the best, believing it to be cheaper than musty or inferior grain."—E. M. Grimes.

YARDING AND HOUSING.

The location of the poultry yards is first to be considered. This should be somewhat higher than the surface of the land surrounding it, and never in a hollow. Avoid flat, damp, sour land if you would have your birds healthy. A piece of ground upon which water stands long after a rain is not a fit place for poultry. A porous soil, slightly sandy or gravelly, is preferable to a clay soil, as it is more easily kept in a sanitary condition, yet the soil should be good enough to support plant life. A southern slope is to be preferred, just as it is best to have buildings front south.

There are two methods of housing—the colony plan and the apartment house. Some advantages of the colony plan, consisting of a large number of small houses, are, no expense for fencing, less need for scrupulous care as to cleanliness, a wider range for the birds, which is an aid to good health, and less need for animal and vegetable foods to be supplied during the summer season. Some disadvantages are, extra amount of labor required in getting around to all the houses, especially in bad weather; greater cost of buildings for same number of birds that could be accommodated in one continuous apartment house, and inability to care for as large a number of birds per acre.

The trouble with too many plans for poultry houses is that they mean too much expense for the average man. However, there are a few general suggestions which all may follow. One mistake often made is that we build our hen houses more to accommodate ourselves than the hen, making them higher than need be, and sacrificing good points for good looks. One objection to the average poultry house is that it is too tight, yet not tight enough. This is to say, that the house should be so constructed as to keep out drafts, but not air. Should half the front be taken out of the average hen house and the material thus obtained, used in closing every crevice in the sides and back, making the building draft-proof, but leaving half the front open except for woven wire, with a curtain to be used in cold or stormy weather, the birds

A POULTRY HOUSE BUILT AT LITTLE COST. DRINKING FOUNTAIN SHOWN IN FOREGROUND.

would be benefited. The house should be dry. Dampness is worse than cold. "Better a cold dry house than a warm damp one." Too much glass in a poultry house means added expense, and more—it causes too great changes in temperature, the sun shining through the glass heating the house in the day and causing it to cool off rapidly at night. The amount of floor space needed for each hen depends somewhat upon the extent of the outside range, as well as upon the size of the building itself, less space per hen being necessary in a large building than in a small one, but five square feet is generally regarded as a fair figure. Eight or ten cubic feet of air space should be allowed each bird. The house should be so constructed as to allow the sun to shine in and back across the entire floor, so that there will be no dark, damp corners. All perches should be placed on a level, and the proper height from the floor will depend considerably upon the kind of birds to be accommodated, the heavier breeds needing lower perches than the lighter ones. From seven to ten inches of perch room is recommended for each bird. The perches should be built so as to be easily removed and cleaned. The entire arrangement of the house should be such as to lessen the labor and to add to thoroughness in cleaning. Lengthy dropping boards are labor savers. Every house should have a scratching shed—"the hen's gymnasium." There should also be, in the sunniest spot in the house, a dust box—"the hen's bath." The location of the nests should be where the hen will have quiet and not too much light.

Of all the plans of housing, that known as the curtain-front system is proving most popular. This is, as the name implies, an open front, or in part open front, house in which curtains take the place of glass in the openings, the curtains being used only when needed. At some of the poultry stations, these houses have proved very satisfactory and are coming into general use throughout the country. The health of birds kept in such houses is generally good, they are less sensitive to cold, and the egg output is increased.

PLANS AND SUGGESTIONS FOR YARDS AND BUILDINGS.

From letters received from Missouri poultry raisers, we take the following:

"I here give particulars of breeding houses, as follows: Material, 2x6 sills spiked onto short post set in ground; 2x4 nail ties. Boxed with yellow pine ship-lap. The cornice I get by boxing first, then run 2x4 around top edge of building, and sheeting extending to outer edge of 2x4, thus making it absolutely tight. Cover ship-lap with tar paper. Roof with best sheeting and 3-ply roofing. After letting stand in weather from four to six months I paint building, including tar paper. Letting building stand a while before painting makes paint stick. Otherwise paint will peel off of yellow pine or tar paper within a year. Partition separating roosting room from scratching department is made of ship-lap. Floor to roosting room is of tongue-and-grooved flooring. Scratching shed floor is of dirt. A few things about house: Both muslin and glass windows, coop up in scratching shed for broody hens, roosts made of 2x6 set loose in sockets, the arrangement beng such as to make each bird roost by itself. This keeps the birds from getting too warm, and is the best roup preventive. These breeding houses I build 8x12 feet, which makes 8x6 roosting room, and 8x6 scratching shed. For entire building the cost is from $23 to $26, depending upon the cost of material at the time of building. These houses I like so well for breeding houses that I would not think of making any changes, even were I building a hundred more."—E. C. McClaskey.

"My house is built tight on three sides, with a large opening on the south, which opening is rarely ever closed except in very stormy weather. I have an old hotbed sash made to slide over the opening which admits plenty of sunshine. The roosts are made of 2x3 lumber with four pieces nailed on for legs, the whole resembling a carpenter's trestle, about two feet high and long enough to accommodate about six hens. I find that by roosting in small companies the birds are less liable to take cold in winter. Where there are a number of fowls on the same roost those in the middle get to sweating at night, and when they come off in the morning before it is quite light enough to feed they become chilled, and the consequence is a cold, then roup, then the hatchet. I believe that this explains why fowls that roost outside in trees with just a few on a limb are seldom, if ever, troubled with roup."—E. J. Lowe.

"Our houses are framed with 2x4, boxed up and covered all over sides and ends with tar paper, put on with batting. The roofing is double ply rubber composition. The houses are 4 feet in the back, by 7 feet high in the front, 10 feet deep, by 12 feet long. Twenty-five birds are kept to a house. The houses have curtain fronts and one door, all on the south side. The curtains are built on a frame, with two frames to a house. The frames are hinged to the top and on nice days are hooked back under the roof, converting the house at once into an open scratching shed, as we keep six or eight inches of straw on the floor all winter, changing the old straw for new as it gets broken up and trashy. The openings for the curtain fronts are covered with wire netting so that in bad weather the fronts can be raised and the birds are still kept in the shed."—T. E. Dunphy.

"Here is my idea of a cheap poultry house: Build foundation two feet from ground and lay on it a double floor of rough boards. Around the ends and north side of this floor, one foot back from edge, nail down 2x4's. To the overhead joists nail another line of 2x4's. To these, at top and bottom, are to be nailed the boxing (boards) for inside wall. If the poultry netting is stretched taut four feet, I think, is close enough for a board. Brace the corners securely before attempting to stretch the poultry wire. The outer wall is made similar to one described, except that boxing is nailed to sills and plates. The space thus formed is to be packed with straw or other material of like nature. The loft is laid of loose boards, or even small poles, and then filled with straw. The front is built on the curtain-front plan. The inside may be arranged to suit the individual, though I strongly favor partitions separating roosting room from scratching department. The roosts are built so as to touch no part of the building. The plan here given may also be modified to suit those who prefer a dirt floor. Roof it both ways and the house will be warm and wind proof."—T. M. Polk, Jr.

"Our houses are constructed with a south, open front. In construction, I use 12-inch barn siding, fitting it close and stripping the cracks with wide batten, or strips. I make the frame 8 feet, 10 inches wide, 4 feet, 9 inches high on the north side and 7 feet, 3 inches high on the south side, and make it any length I wish. I use these measurements to save lumber. A ten-foot, 2x4, will make the rafters, which I put on before I put on the siding, and in putting the siding on, I put it even with the top of the sheeting, in order to avoid all drafts. Ten-foot boards cut into two pieces of equal length will side the lower side, and twelve-foot boards properly sawed will side the ends without any waste. By constructing the house 8 feet, 10 inches wide, nine widths of the board will be exactly sufficient to cover the ends. I put a 12-inch board at the bottom on the front side so that I can staple the wire front to it. I board up 12 or 14 inches at the top, on the front side to suit the width of the wire. I use a small mesh poultry wire and stretch it as tight as I can. If I can not get wire sufficiently wide, I get two pieces, which by splicing will make the proper width and sew them together with baling wire. Any kind of a canvas curtain will do for the front, in case of stormy weather. I have known some to use old carpet and it seemed to do very well. We very seldom have occasion to use the curtain, and our chickens' combs have never frozen, nor do the chickens have colds, and they do not stop laying all through the winter. I use shingles for roofing, and put the doors in the ends of the house. I construct the roosts on a level and put them about two feet from the floor. By taking 2x4's and fastening one end to the north wall, and supporting the other end by a wire swung from the rafter, I make them level. I then put poles on the 2x4's for roosts. I make my houses low because I think it is warmer in winter time."—E. M. Grimes.

A MISSOURI PLYMOUTH ROCK HEN, WINNER OF FIRST PRIZE AT LOUISIANA PURCHASE EXPOSITION.

"I have been using the open front hen house for the past three years and find it so much better than the closed ones that I wish others to be benefited by my experience. Besides, I am doing the hens a great favor, as they are so much healthier and happier and will lay more eggs. Such a house can also be built cheaper than any other, as it requires no windows, which make a house too warm, and then too cold. Then in the hot summer time such a house is cool, as the heat from the sun on the sides and roof passes off at the upper opening, so the hens have a more even temperature both day and night. My hens prefer it to other shade in the hot summer days. This house always has dry, pure air, and even the droppings dry up quickly, no matter what the weather is. The accompanying ground plan shows two pens, each 12x24½ feet with dropping boards at the north end 3½ feet wide, with three roosts bolted to pieces that have legs at one end 8 inches long and the other end hinged to the wall, so that the roosts can be lifted and hooked up to a rafter when cleaning the dropping boards. I have very simple trap nests just under the dropping boards. They are made of orange boxes. The partitions between the pens should be boarded up tight from the north side to the door, so as to avoid any draft back on the roosts. The water vessels and dry-mash box I put in the partition on a platform 3½ feet by 4 feet and raise it 14 inches from the ground. The dust bath is 2½x5, in the sunny south end. The south end of the house, both above and below, should be covered with one-inch mesh wire netting to keep the sparrows out, and on the inside of the upper opening should be a wooden frame hung on hinges at the top and provided with rope and pulley, so it can be raised and lowered when desired. There should be a good solid foundation under this house, and it should be raised from 6 inches to a foot, according to the dampness of the soil, and filled in nearly up to the sills with stone or dirt, then three inches of clay should be spread on top and thoroughly wet and tamped down level, which makes an excellent warm, durable floor. The frame can be built with 2x4's, except that the pieces which hold up the upper ends of the rafters should be 2x6. Cover the sides and back end with good inch lumber 1x12, and batten every crack, then thoroughly paint it. Cover the top with some good felt roofing. Cover the clay floor all over with a foot of leaves or straw and feed all grain in them and you have a healthy happy hen family."—D. J. Bliss.

"The average size of our poultry houses is 6x6 feet, 3½ feet in rear and 8-foot front, boxed and stripped, with door and window in south side. Doors are 2x6 feet, and windows made of four 10x12-inch lights. The roosts are portable, and 18 inches from the earth floor. In such a house a dozen hens will do well, and in zero weather we put from 20 to 25 head in these houses, and they don't get their combs frozen, but in large open houses they freeze their combs. We find that small houses and small flocks pay largest dividends. We advocate plenty of room for range and house. As it gets colder put more birds to a room, so that their own heat will keep their combs from freezing. A cloth curtain over window, when thermometer is at zero, is a great help to prevent frozen combs. In a long poultry house, as the weather gets colder, a wagon sheet used as a partition to cause fowls to roost closer together is just the thing, keeping in their heat and letting them have plenty of ventilation. During the day open glass windows, leaving only the cloth curtains before the openings."—John R. Garber.

"I think the cheapest and best house for Southwest Missouri is a concrete building 8 feet high, 12 feet wide and long enough to accommodate the size flock one may care to keep. Make floor of concrete."—Mrs. J. M. Butts.

"The hennery of State Hospital No. 3 was put in operation January 21, 1908. During the eight months ending October 1, it produced for the use of the institution 2,716 pounds of poultry and 5,201 dozen eggs. In this aggregate the eggs used in the incubators are not counted. The poultry man's report for this period shows an expenditure, including his own wages at $50 per month, of $643.37. The total value of the product at market prices was a little more than $1,200. The food supplied the hens was largely table scraps. The appropriation made by the last General Assembly for the establishment of this hennery was $2,500. Nine cement houses were built for the hens at a cost of about $85 each. These houses are double, each room being 14x18, making the entire structure 14x36 feet. Each single room carries from 50 to 60 hens, and has a yard of one-half acre. The south side of the house is about one-half windows and doors, and canvas is used in the openings instead of glass. An incubator house made much like the other cement buildings furnishes room for the five incubators and the indoor brooders. The poultryman has a neat little cottage immediately adjacent to the yards and lives with the chickens. The hens number about 1,000. Health among them has been exceptionally good, and they have testified their appreciation of kind attention by liberal laying."—A. Cummins, Steward.

"Our plant is located upon 50 acres of ground, at the present time, about fifteen acres of which is devoted entirely to the raising of poultry. A peach and apple orchard of about two acres is divided into ten large yards or run-ways, in which the breeding stock is kept. This provides the fowl with ample range and shade, the shade preventing them from becoming rusty and sunburned. The yards are sown in a mixture of many grasses, including orchard grass, which thrive luxuriantly. Each house is provided with an apartment open to the south; in this the fowls are fed during the winter, the floor of same being covered with leaves (oak and hickory preferred) or straw. The feed is scattered in the litter upon the floor, the fowls being compelled in this manner to work for their food, thus keeping warm and healthy. Ground bone, oyster shell, grit and charcoal are kept in hoppers, where the fowl can get them at all times. Green and soft food and green bone is provided about once or twice a week, depending largely upon the apparent condition of the fowl. The most important of all, and that upon which the greatest stress must be laid, is, that water should be furnished the fowls very often and in abundance. During the winter, the water is heated and given from two to five times a day. No hen will lay unless she can get plenty of water, no matter how well she is fed. The roosting house is partitioned off from the scratching apartment, and is made very warm, but no artificial heat is furnished. The roosts are made of 2x4 scantlings, which have been planed on the edges, and which are set in cleats so that they can be removed without trouble and cleaned, and in this manner kept free from vermin. Underneath the roosts are dropping boards, and underneath the dropping boards are nests. The hens in this way are provided a dark and quiet place for laying. The setting of the hens and incubators begins about the middle of December, and stops the first of June. There are two places in which the hatching in incubators is done; one is in the cellar under the main residence, and the other is in a special house erected at the end of a long brooder house. This latter house being double boarded, tar papered and made very dark and tight, there being but one small window on the southern side. A folding door leads from this incubator house into the brooder house. The brooder house has a long hallway to the back, and from this hallway there are twenty or more separate pens or runways, and in each one of these is located a brooder of sufficient capacity to house one hundred chicks. This house has a total capacity of over two thousand young chicks. This house is heated by a large stove, which is only used in extreme weather, as the heat from the brooders is sufficient to keep it at proper temperature nearly all of the time. The idea of having the incubator house and brooder house opening into each other is to avoid the necessity of exposing the young chicks to cold weather, when they are taken from the incubator and placed in the brooder, as the slightest chill at this time will cause certain death in a few days. There are other brooder houses and coops on the farm for the use of the chicks, as the weather gets warmer. Another building, and probably the most interesting, is known as the cockerel house. This house is sixty feet long, with a hallway through the center and with runways leading off on each side, having a total of thirty different runways. On the side of each runway about three feet from the ground is located a coop with two partitions. In this way ninety male birds can be kept separately, in condition for exhibition purposes, and kept in good feather, health, style and spirit, as the male birds, when permitted to run in flocks, fight each other, injuring combs and plumage, often retarding growth and appearance of the more timid ones. This house is considered the most valuable and important one on the place."—W. W. Henderson.

COCKEREL HOUSE ON A MISSOURI POULTRY FARM.

EGG PRODUCTION.

Many things affect egg production. Important as is food, it is only a single factor. Under ideal conditions the healthy, happy hen is a practically perfect egg machine, but the hen is not always healthy and happy, nor are conditions always ideal. Food may not be of the right kind, or given in the proper quantity; the surroundings may be unsanitary, or too hot or too cold; too many birds may be crowded into a single building; they may be frightened and disturbed; may lack sunshine and exercise; lice or mites may interfere; the hen may lack constitutional vigor, or may not have the proper conformity to egg laying; she may not come of a laying breed, or she may come of a laying breed, yet not of the best laying strain. Thus does the problem of heavy egg production largely resolve itself into one of how to keep the laying hen in the highest state of health.

The happy hen, like the happy man, will do the best work. The lazy, excessively fat or excessively lean hens have all been failures as layers. "A very fat hen will not lay well, and a very poor hen cannot lay well." We must, then, let our aim be the happy medium.

Every poultryman is interested in knowing how to get the largest number of eggs from a given number of hens in the shortest time and at the least expense—to gather two eggs where only one gathered before, as it were. The average hen on the farm does not produce 100 eggs per year, but she ought to produce a gross of eggs—a dozen dozen—each year. There are a number of cases on record where hens have produced more than 250 eggs per year, but this is a record such as the average poultryman cannot hope to equal.

For increased egg production we should discard drones and breed producers to producers, mating strong, but not related, individuals of the same variety. Thus may we develop a laying strain, for birds may stamp their capabilities on their progeny. One of the first problems, then, is to determine the layers. This we may do by using trap nests. A trap nest is an arrangement for catching the hen that lays the egg. There are many kinds of trap nests on the market, but the principle of all is the same. When the hen enters the nest to lay an egg the door is closed, and she cannot get out until released. Trap nests require too much time and attention to be kept in use at all times on the farm, but if used even occasionally they may be of great value in gathering information as to the best layers. By using trap nests the best egg producing hens will not be sold, but the drones may be determined and disposed of. When trap nests are used, each hen should be provided with a leg band, and an accurate record of eggs produced entered in a book provided for that purpose.

The laying hen is the young hen, and in order to have good winter layers pullets should mature early. Hens that are past two years old, or three at the most, do not, as a rule, prove profitable.

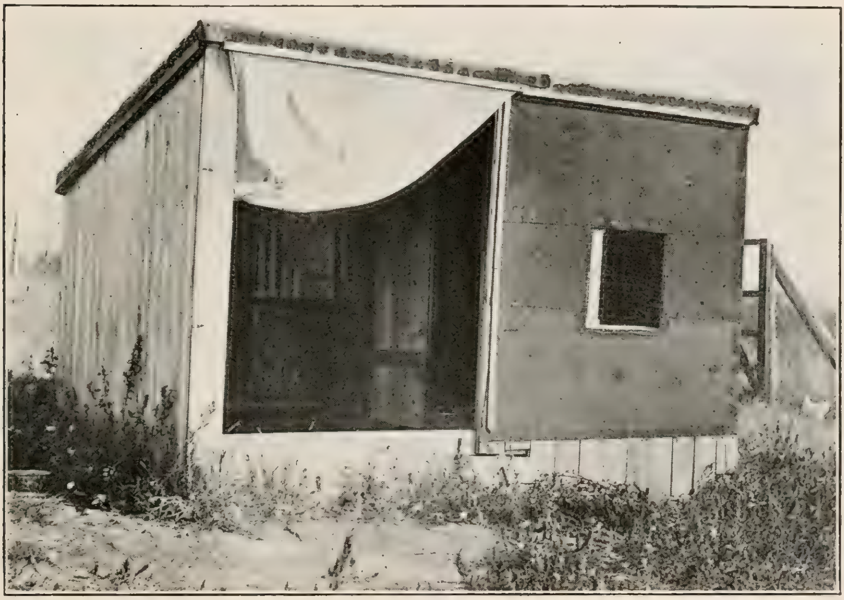
Some contend that there is as distinct type for the laying hen as for the dairy cow. On this subject one authority writes, "It has been said that there is no difference in the egg-laying capacity of breeds but only of strains. To this a distinct denial must be made. For instance, a game fowl has no conformity to egg-laying, and could never be brought up by the most scientific selection to the capacity of an Italian Leghorn, whose conformity is naturally adapted to prolific egg production."

"It is easy enough to have eggs when everybody else has them, but what we want is eggs when scarcely anybody else has them." Eggs are low in price and plentiful in warm weather, and high and scarce in cold weather. So the most profit comes in winter egg production, which will depend largely upon housing and feeding. These subjects are taken up in other chapters. In the main, it may be said that the laying hen requires a highly nitrogenous ration. To the grains ordinarily used as poultry food should be added beef scraps or other similar materials. Sour skim milk is good for laying hens. Plenty of green food is also needed.

"Last February we got 100 dozen eggs from 80 hens. Our neighbors all around us got scarcely any. Two of our neighbors, each of whom had as many chickens as we have, claimed they did not get any eggs in February. They thought we had some secret way of making our hens lay, and did not want to tell. The fact is, we only fed our birds lots of wheat and other feed, including fresh meat, and made them work for it. We also kept plenty of oyster shell, where they could get it."—James Grover.

To increase the output of all the Missouri hens one dozen eggs each per year would be to place no less than $2,000,000 additional in the purses of those engaged in poultry production in the State.

"In selecting fowls for their egg laying qualities and to improve along this line there are several methods that can be followed. To the breeder of fancy fowls the trap-nest is the most reliable and accurate, but to the general breeder and to the farmer this method causes too much work. Therefore, they must resort to other methods. It has been proven that pullets raised from a hen that has proved herself a heavy layer, will, as a rule, be heavy layers themselves, but we must remember that the male has a great influence on the flock, so to make a greater improvement in the building up of the flock we should breed these pullets to a male that is known to be from a heavy laying strain, and the produce from this mating should increase in their egg laying qualities, and so by careful selection on and on we cannot tell just what limit can be reached. My own experience shows a little what can be done. From a start about six years ago with trap nests I found my flock was giving me an average of about 115 eggs per year. By careful selection by means of the trap nest, I have increased the average until last year it was 200 eggs for the flock, and some individuals produced as high as 237 eggs for the year. Am still striving to beat that this year. This shows something of what can be done by proper selection; but as I have said before, the average farmer and general breeder cannot spare the time to look after trap nests. However, what breeder or farmer's wife or daughter is there who likes fowls and works with them, who does not know just about how 'Old Speckle' and many other hens on the place lay? By a little close observation you can nearly always tell the hens that are laying the most eggs, and those that lay for the longest period. Right here let me say, always save eggs from such hens for setting purposes; keep them separate from all other eggs, and when the chicks hatch, mark them so that you will know them, and be sure and keep the best of them for your next season's breeders. If you will do this and keep it up for a few years, always remembering to use a male that you know to be from a heavy laying strain, you will surely reap your reward by the increased production of eggs that is sure to follow, also by the uniformity of your flock that always is the result of close culling. Cull closely, but try not to discard the laying hen. A little time in observation around the nests at laying time will soon show you which hens are doing the laying, and if I am not mistaken you will soon find in your flock a large number of hens that are scarcely ever seen on the nests. These drones are the ones that are eating up the profits of the average flock, and the sooner you can market them, the more profit you will make from the balance of your flock. Save nothing but the ones that are proving themselves good layers. Nearly every poultry raiser who will study and observe his flock closely can soon tell the laying hen by her shape. Study well the shape of the hens you know to be good layers, and you will find that all the best laying hens in your flock have nearly the same characteristics, as far as shape is concerned. There are not many flocks but which, with close observance and constancy, cannot be made to increase in egg yield from fifty to one hundred per cent, according to the number of hens kept, and if this is done, I think you will agree with me that your time has been well spent in making the improvement."—E. C. Branch.



A MODERN AND INEXPENSIVE CURTAIN FRONT HOUSE.

(See page 417).

MARKETING.

The path of profit in poultry leads from pen, through market place, into pot or pan. The paramount question, then becomes, how, where and when is it possible for the poultryman to dispose of his surplus products to the best advantage? By "best advantage" is meant, not only the most money for today, but a lengthening list of satisfied customers for tomorrow.

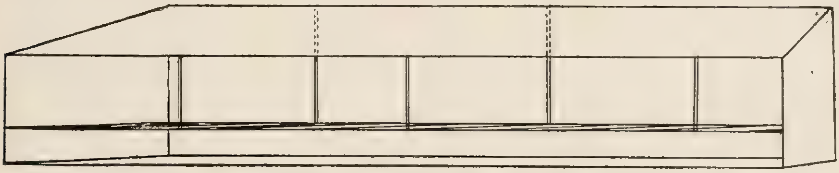
Each year Missouri farmers and poultrymen lose in the aggregate, thousands, perhaps millions of dollars, because of poor methods in marketing, yet few stop to count the cost of this carelessness.

The poultryman must sell to the consumer or the dealer. In either case he should remember that poultry, even more than people, is judged by appearances—even though appearances may sometimes be deceptive. "A dirty egg is a disgrace to the one who sells it."

Are you going to sell direct to the consumer? If so, there are many things to be considered. You must know your market, for different markets have different requirements. For instance, "In Boston, Providence and other important New England markets the fancy trade demands brown-shelled eggs. In New York, best prices are received for eggs with white shells." Then you will profit by it if you are able to cater to the wants of each individual customer. In delivering goods direct to the consumer, a neat packages, upon which is printed or stenciled the farm name, will prove a good investment. It is generally true that the seller who takes pains to prepare a neat package will usually see that it is filled with goods of first-class quality. To put nice clean eggs in dirty boxes or baskets is to do injustice to the hen. A neat package attracts customers. A high-class trade is worth working for, but it must be remembered that a high-class trade demands high-class goods. If the goods are not better than can be bought on the open market the consumer will not long continue to pay the poultryman fancy prices. Selling eggs direct to the consumer also demands that the supply be continuous, and not only continuous, but regular. The best buyers are looking for the man who can furnish them eggs when eggs are scarce. The ability to supply eggs when they are hard to obtain elsewhere will often mean a customer throughout the year. "Extra quality goods, attractively put up, delivered at the right time and to the right person, means easy money." The extra price per dozen which is paid for quality is almost clear gain. An advance of five cents per dozen on ten dozen eggs is fifty cents, and on 200 hens, averaging 120 eggs per year, the advance amounts to $100 annually. In every large city, and in many smaller ones, are families who are willing to pay a premium for choice goods. The largest returns come from supplying such customers, but it must be remembered that not every poultryman is prepared to do so with profit. Selling direct to the consumer means much more care and considerably more labor and expense. There is also more risk. "One bad egg will ruin the reputation gained by selling a thousand good ones." The poultryman who is able to deliver, regularly and continuously, goods of guaranteed superiority, will experience no trouble in securing and holding good customers. One Missouri poultry dealer writes as follows:

"For the coming season, I have a private customer in Chicago who pays me one cent advance over highest Chicago market, eggs to be delivered at express office at my home town. This will be six or seven cents per dozen better than local market."

As a general proposition it is the best plan to sell poultry and eggs to the dealer, provided he is willing to recognize quality, for much of the complaint that is heard against him is unjust. There are two sides to the question. First, a price that is uniform, is unfair. Second, when a dealer pays for fresh eggs and good poultry, he is entitled to what he pays for. As to the first proposition, it may be said that there is no more reason why all the poultry should be bought at a price that is uniform—the same price for the scrawniest and the fattest—than that all hogs, sheep, or cattle should sell alike on the market. Such a system may mean the average worth of all the poultry and the actual worth of none. It does not offer proper encouragement to the farmer with good chickens. In many parts of Missouri, most of the poultry and eggs is sold right at the farm, where drivers of poultry wagons receive and pay for it, the uniform price for the day being fixed before the driver starts out on his route. The result is that chickens, good and bad, are crowded into the same coops, and eggs, fresh and stale, placed in the same cases. So that the farmer who sells inferior goods gets just as much credit—and just as much cash—as his neighbor who supplies the best. Some buyers pursue a different policy, paying a premium for fresh, clean eggs of good color and size, and for choice, well-fatted birds, but as yet the practice is not as common as it should become. Shippers and dealers should stimulate the raising of good poultry. One extensive Missouri dealer is doing this by furnishing pure bred cockerels to



INTERIOR VIEW OF HOUSE, SHOWING ROOSTS SUSPENDED ON A LEVEL. (See page 418).

his customers at only a small advance over what he allows them for their scrub stock. The result is that there is already a marked improvement in the quality of the poultry marketed at his place.

"I am ready to add my mite toward helping to arouse an interest in good poultry, that it may hasten the day when the market-man will be forced to discriminate between choice poultry and scrubs, just as the grocer now does between creamery and country butter."—Miss Annie Hoffarth.

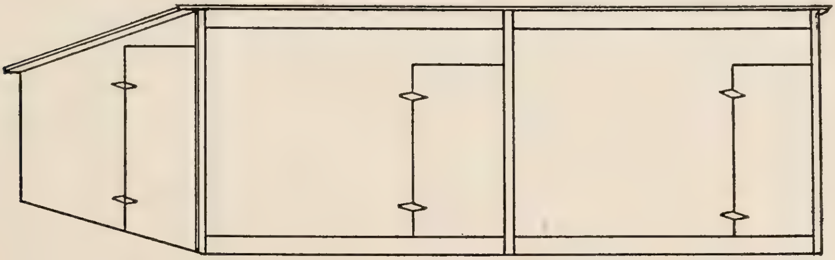
As to the second part of the market proposition, it may be said that the farmer may also be at fault.

One of the most prominent poultry raisers in Missouri writes, under date of August 25, "Eggs that have been coming to market for three months have been running from 30 to 60 per cent off, with the result that such eggs have been selling in case lots at from 13 to 15 cents per dozen. These same eggs, when sorted and candled, have been bringing 20 to 21 cents per dozen, while myself and other poultry fanciers have been, and are selling our surplus product for eating purposes at 30 to 35 cents per dozen." This same writer adds, "Spring chickens, weighing 1 to 1½ pounds each, are ready sale during March and best part of April at $6 to $7 per dozen. They must, however, be fed so as to attain this size and weight at eight and not over nine weeks. A large poultry plant, capable of supplying eggs (every egg stamped and dated) and poultry of quality in quantities sufficient to fill the wants of our best hotels and restaurants will, in my opinion, be a profitable venture."

All stock should be sorted. "A high-priced buyer will not want the inferior stock at any price; therefore, if different grades are mixed, the good stock will have to go to the cheap buyer." Farmers who cannot market eggs every few days, should be prepared to test them and to know that they are selling none but good eggs. Only a very simple contrivance is needed for candling, the principle being that the fresh egg when placed at the end of a tube or funnel of suitable size or in an opening beyond which there is a strong light, appears clear and bright, showing no dark spot. Some dealers buy eggs with the loss off, deducting for bad ones which fail to stand the test when candled.

Cold storage has, by acting as a balance wheel, rapidly revolutionized the poultry business. Eggs no longer "sell for a song" in summer time. There is also a demand for poultry throughout the year, because of refrigeration. Most Missouri poultry is sold alive, then taken to the plants, where it is dressed, packed and prepared for shipment. The birds are dry picked. Dry-picking is always to be preferred when preparing fowls for market. As most people do not understand the dry-picking method, nor know how to kill the chickens by sticking, it will, as a rule, be found best to sell the fowls on foot. If birds picked other than by the dry process, are torn in picking and are not properly preserved and plumped, the sale is sure to prove a disappointment.

Sell the surplus cockerels. You can not afford to keep them all summer "simply for the sake of their society," as the price generally decreases with the added age and weight of the bird. Some have found it profitable to convert the cockerels of the heavy breeds into capons. On this subject, R. T. Colborn, a Missouri poultry raiser, writes, "I have no difficulty in raising these birds, and find a ready market at home, men coming to me from Chicago and paying as much as $1.04 per head. By the introduction of caponizing the mischief-making cockerel is transformed into a tranquil, majestic fowl, moving at leisure about the yard and getting fatter and heavier every day. As a seller he is the peer of any fowl, yielding the greatest returns to the poultry raiser, and having been changed by a process so simple that anyone equipped with the proper tools can do it."



A Double House, each side opening into a separate pen. The front of this House is covered with poultry wire, and it is arranged so that a canvas can be attached and lowered as siding, for protection in stormy weather. (See page 420).

The following on the subject of care and marketing of eggs is contributed by the manager of one of the largest commission companies in Missouri: "As every one knows, the egg production of this state amounts to millions of dollars annually, and all the writers and institutes urge a larger production; but we who buy and sell these eggs believe that if the farmers would take better care of what they now produce, it would make them more money than to enlarge the production. With most farmers 'an egg is an egg,' but when it comes to the sale of them to the people who eat them, it is found that the consumer does not think so, and we have to grade them accordingly. For example, in the month of July, I bought 1,600 cases of eggs, costing about 14 cents per dozen here. Of these, 70 per cent were fresh, 20 per cent were stale, small and dirty, and sold for eleven cents per dozen, and 10 per cent were rotten and were an absolute loss. The August loss ran about 5 per cent higher, the September loss about the same; the October loss has been about one-half less on bad eggs, but the per cent of small and dirty has been about the same. November receipts are generally fresh stock, but in December we usually receive a lot of held, stale stock that forces down the market price from two to five cents per dozen, resulting in financial loss to all parties concerned.

"If one firm shows losses as above stated, just think what the entire loss in the State and the United States amounts to. It is simply enormous, and that is not all; when eggs are fresh, people will eat them and will pay good prices to get them, but, just as soon as they get a few that are not strictly fresh, they turn to something else and eschew eggs. I do not believe that eggs would ever sell for less than fifteen cents per dozen in the country if all came to the market fresh and firm. We urge the farmers to observe the following rules, and give us good, fresh, clean stock, any they will find that it will fully repay the extra care:

"1. See that the hens have clean, dry nests to lay in.

2. Gather the eggs daily and keep in a cool, dry place—not in the kitchen or damp cellar.

3. Market them at least once per week, oftener if possible.

4. Do not wash eggs; they soon spoil.

5. Do not market eggs that have proved not fertile in the incubator; it is criminal.

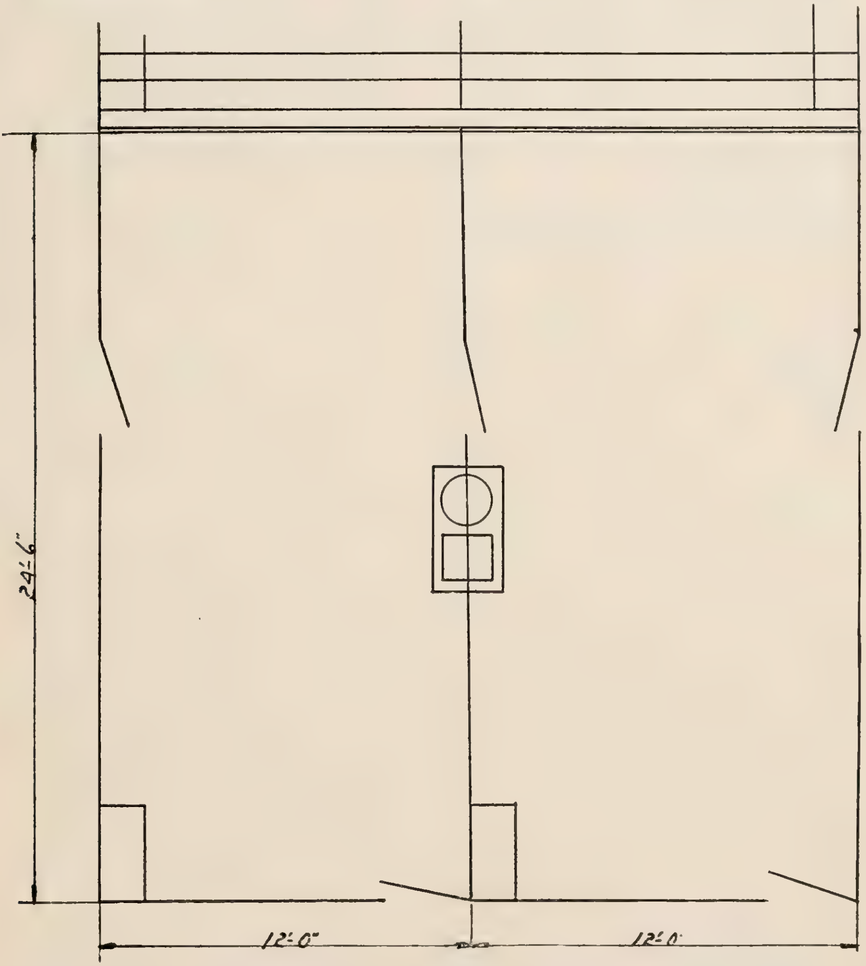
6. Use the small and dirty eggs at home; they are just as good if you know they are fresh, but they lessen the value of the others when they reach the market.

7. Do not pack in salt or damp sawdust; an egg will absorb any odor that butter will."

THE POULTRY SHOW.

With State, district and county poultry shows, no Missouri fancier should fail to exhibit his birds, for it is a part—a big part—of his business. The educational and advertising features are most important. Those who attend the shows become interested in better birds and often buy, so the exhibitor has first chance at this business. Farmers and all others who are in any way interested in poultry production should attend the local show and, if possible, other poultry shows, where they may see and study.

Birds need to be prepared for exhibition, and the work should be commenced in time. First in importance is the selection of the birds. They should come from healthy stock and be strong and vigorous. Be sure that they have the size, also the style. Look for swagger in the male bird. Don't make the mistake of selecting a timid, cowering cock or cockerel for the show. The females



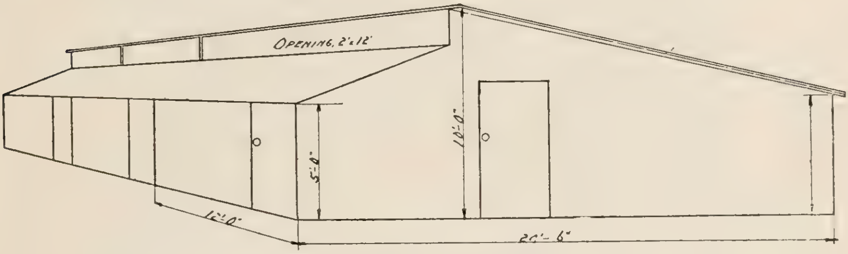
This Ground Plan shows two pens, each 12 x 24½ feet, with dropping boards at the north end 3½ feet wide, with three roosts bolted to pieces that have legs at one end eight inches long, and the other end hinged to the wall, so that the roosts may be lifted and hooked up to a rafter when cleaning the dropping boards.
(See page 420).

should all be of one type and shape and should agree as to general appearances, thus insuring a pen that is uniform. One very dark or very light bird may detract from all others. Of course, the birds selected should come as near as possible to the recognized standard of perfection. Show birds should be kept in celibacy for a few weeks before the show. A week or more before the exhibition they should be weighed and if any are found to be under weight, they should be fattened by being fed lean, raw beef and hard corn, with scalded milk to drink. Don't, however, rely too much on forcing your birds, for fat is not form. Handle them frequently, teaching them to pose and to assume the right attitude. Get them gentle. See that they are not coop shy. Try them out in a coop resembling an exhibtion coop. Make frequent changes in your clothes, especially your hat, so that they will not be afraid of strangers. Birds, especially of white breeds, need to be washed for the show pen. If this is properly done it will help, but improper washing is worse than none. First, lather the bird with some good soap—some use shaving soap—and allow the lather to remain until the feathers are clean. Then rinse thoroughly in luke-warm water. Follow with a bath in water to which a little indigo has been added. After the birds have been allowed to shake themselves they may be wrapped in a woolen blanket or anything else that will take up the moisture. Some birds, especially those of black plumage, need to be groomed by being rubbed with a brush and cloth. The legs may be greased occasionally in order to keep them clean and bright. Look well to the cleanliness of the coops in which birds are to be placed. Keep in mind the fact that lack of preparation, rather than lack of quality, may defeat an exhibitor. You can hardly hope to catch up the fowls the day before the show and win over birds that have been properly fitted.

HEALTH OF THE FOWLS.

Josh Billings is credited with saying, "The best way to cure anything is to stop it before it happens." The poultry raiser will do well to keep this maxim in mind, for comparatively little is known on the subject of poultry diseases. Prevention must be the fundamental idea. "A pound of prevention is worth a ton of cure." Disinfectants are cheaper than disease. Use lime freely, for it is one of the best disinfectants. It is disease, not health, that is contagious. Absolute cleanliness is the first consideration. In the poultry business filth means failure, just as dark, damp quarters mean disease. Birds can no more do their best without fresh air, exercise and sunshine than without proper food and water. The hen, to keep healthy, must also have her bath—a dust bath. "A dust bath is as essential to a hen's health and happiness as a water bath is to the health of a human being."

Do not allow droppings and filth to accumulate, nor let drinking vessels become coated with slime. Unless great care is exercised there is danger in having the poultry plant located in the same place year after year, for to do so is to increase danger from disease. If the yard cannot be changed it might be plowed up and sown to small grain. If plowing is not possible sprinkle air-slacked lime over the ground, in the early spring, then, after a few days, remove it with half an inch of the top soil. Another plan is to cover the soil with water into which has been mixed some sulphuric acid or other disinfectant.



POULTRY HOUSE RECOMMENDED BY D. J. BLISS.

(See page 420).

A frequent cause of the spread of disease is the practice of throwing dead fowls along the roadside. Such a practice cannot be too strongly condemned, and should be prohibited by law. It often happens that disease breaks out and the fowls are sold. Those that die on the trip to town are thrown out, where the carcasses may be eaten and infection result. Almost every one who has traveled over the public highways in Missouri has at times noticed dead birds along the roadside, where they have been thrown by drivers of poultry wagons or by thoughtless farmers. Another source of infection is running streams. Such birds as die of disease should never be thrown where the disease may be spread to another flock to which a running stream may carry germs. Burn all birds that die, or bury them good and deep, and do so without delay.

Do everything possible to prevent the outbreak of disease, but if it does come, isolate the affected fowls if you would escape the depletion of the flock.

While it is too often true that the hatchet and the chopping block are the only cure, there are certain remedies which are generally recommended in case of sickness in poultry. Some of the most common poultry diseases and other troubles with which the poultry raiser has to contend, are referred to in the following paragraphs:

Gapes.—"Gapes is a poultry parasitic disease more easily prevented than cured." It is so called because of the characteristic gasping movement of the chick into whose trachea, or windpipe, small red worms, about one-third of an inch in length and with smooth bodies and pointed tails, have become so numerous as to interfere with breathing. Young chicks suffer most. Some believe that the angle worm is the cause of the spreading of gapes. Cleanliness and keeping chicks on a board floor until they are large enough to resist the attacks of the worms are the best preventives. A chick affected with gapes may often be relieved if a feather, horse hair or a bit of grass is passed down its throat and worms removed. Another remedy is to fasten the affected birds in a box over which a thin cloth has been placed and through this sift lime, but care must be taken lest too much lime be used. A French scientist asserts that the use of pounded garlic in food has completely eradicated the disease among pheasants in Europe.

Roup.—The first symptoms of roup are sneezing and running at the nostrils, the discharge having a very offensive odor. Unless the trouble is checked the nostrils fill up, the head and face become swollen, air bubbles appear in the corners of the eyes, appetite fails, the comb turns black, and death follows. The disease is very contagious, so that the sick birds should be separated from the well ones. Then seek the cause of the trouble, which may be overheating followed by exposure, or it may be that the birds have been exposed to drafts. The curtain-front house is doing much to lessen the losses from roup. One remedy for the disease is a few drops of tincture of muriate of iron and a small piece of gum camphor in the drinking water. Some suggest injecting ordinary kerosene into the nostrils, then bathe head with one part soda and four parts water. Roup is generally accompanied by a form of canker in the mouth and throat, which should be swabbed out and followed by a 10 per cent solution of nitrate of silver. Another remedy sometimes recommended is to dissolve two ounces permanganate of potash in 6½ pints of water, then hold bird's head in this as long as it can stand it.

Mrs. J. M. Baugher writes as follows concerning roup: "One of the first signs of roup is sneezing or whistling, or an unnatural appearance of the eyes and comb. Sometimes the eye lids are swollen and corruption in corner noticed. Separate the fowl showing these signs from the flock at once, as roup is diphtheritic in form and spreads rapidly.

"It is not wise to let children treat fowls with roup.

"I used a tight wagon-box, placed on the ground, with side boards and cover, to prevent draft, for hospital, using plenty of chaff for bedding and ventilating from top. Every chicken showing signs of roup was treated and put in this hospital. The treatment was simple, though effective. The throat, comb, nostrils and wattles are thoroughly swabbed with a feather dipped in zenoleum, then burn the feather. Use a small insect bellows to blow dry sulphur down the throat. As the treatment is severe, the fowls do not often care to eat before 24 hours, but place pure fresh water in hospital for them. If at the end of 24 hours they are not ready to eat of their own accord, treat again and force them to eat some warm, soft food containing some kind of good poultry tonic.

PARTIAL VIEW OF MODERN POULTRY PLANT, BUILT AT COMPARATIVELY SMALL COST.

"Last winter I was frightened when the roup broke out in my flock of 250 chickens, but by this treatment I saved every one. Sometimes I had 20 in the hospital at once. The outbreak was caused by a draft in the roosting room.

"I find the best way of ventilating a roosting room is to tack a gunny sack over the openings left for ventilation. These can easily be removed in warm weather."

Cholera—Cholera in poultry is a contagious disease of the bowels. It may be recognized by the green or yellow color and the frothy nature of the droppings. The feathers assume an unnatural position, the birds show a disinclination to move about, and evidence an unusual thirst. Drowsiness immediately precedes death. which often occurs within a few hours, and nearly always within two or three days after the bird becomes sick. A mucous discharge from the mouth is occasionally noticed. When it is certain that the disease is cholera, the best plan is to kill the sick bird, or at least isolate it, so that the bacteria in the droppings will not mix with the food of the well birds, nor the liquid which drips from the beaks of the sick, feverish birds get into the drinking water. Try to eliminate every possible source of infection. To destroy the bacteria use corrosive sublimate in drinking water, in stone fountains; but do not use more than one part of this poison to 1,000 or 2,000 parts water. Sprinkle diluted crude carbolic acid about buildings and grounds. Ten drops of sulphuric acid in one gallon of water twice a week in summer is a wise precaution against fowl cholera.

Limberneck—This disease, which takes its name from the characteristic limber condition of the neck, attacks fowls that have had access to carrion or other decaying matter filled with maggots or worms, which often remain alive in the bird's crop, causing partial paralysis of the muscles of the neck. When fowls are allowed to eat decaying flesh in which is ptomaine, limberneck is almost sure to follow. Some authorities also contend that the disease may be caused by parasites in the intenstines. In this, as in every other poultry disease, prevention is better than cure. Do not leave decaying flesh where fowls will have access to it. One remedy recommended for sick birds is a few drops of turpentine and sweet oil followed in a few minutes by some warm sweet milk, or a feed of grain soaked in turpentine may be tried. Another treatment proposed is to give the sick bird slugs or pills made of equal parts pure lard, cayenne pepper, powdered sugar and mustard. Give a pill every three hours during the day.

Tuberculosis—"Tuberculosis is an infectious disease caused by organisms, known as tubercle bacteria, which gain entrance to certain organs of the body and multiply there. The nodular growths (tubercles), so constantly found in tuberculosis, are caused by the presence of these bacteria in the affected regions. The spread of tuberculosis from one fowl to another occurs only when conditions permit the transfer of the live tubercle bacteria more or less directly from the diseased to the healthy."—Archibald R. Ward.—Droppings from sick fowls may prove sources of infection, causing the disease to spread. As there is no known unfailing cure, the safe plan is to kill the affected birds.

Blackhead—Blackhead was first noticed in New England, where it caused great loss to turkey raisers. It is described as a disease which first attacks the cecum, situated between the large and the small intestines. It may also attack the liver, which becomes very much enlarged. While the disease is generally attributed to microbes, it is believed to be very much aggravated where inbreeding is too much resorted to. Diarrhea is a common symptom. The disease takes its name from a peculiar discoloration of the head. Birds of depleted vitality are the ones generally attacked, so that the addition of new, strong and healthy stock is recommended. Some have tried introducing wild blood into their flocks. Treatment of sick birds has not proved very successful. Among the remedies most recommended are sulphur, sulphate of iron and quinine. 'Sulphur may be given, 5 to 10 grains being combined with one grain of sulphate of iron; or sulphur, 10 grains, sulphate of iron, 1 grain, and sulphate of quinine, 1 grain. It is necessary that such treatment be repeated two or three times a day and continued for a considerable time to obtain results."

PEKIN DUCKS ON A MISSOURI FARM.

Diarrhea—The first thing in the treatment of diarrhea is to remove the cause, which may be bad feeding, dampness, filth or lice. A remedy often used is a mixture of equal parts of ground ginger, cinnamon, cloves and cayenne pepper. This is mixed into the mashed food, about a level teaspoonful to a dozen birds. Feeding boiled rice and a little charcoal may help. Dry food and lime water will also prove beneficial. A form of diarrhea, commonly known as "white diarrhea," is very fatal to young chicks, especially to those hatched in an over-heated incubator. It may also be caused by allowing the chicks to become chilled, by feeding them sloppy food, by poor ventilation, or, perhaps, most of all, by lack of vitality in the breeding stock. It is not, as a rule, so bad in early-hatched chicks. There is no positive cure for the disease, but the use of boiled milk instead of water is recommended. J. C. Needels, a Missouri poultryman, writes, "My chief drawback in raising chickens is what is called 'white diarrhea,' which attacks the chicks when they are very young. I have found no remedy, but the use of dry prepared chick feeds has lessened the trouble, and sometimes helped to avoid it."

Bumblefoot—Bumblefoot is a bruise on the fowl's foot, usually caused by the bird flying from a high perch and alighting on a hard substance. Bandage the foot and apply tincture of iodine. In aggravated cases it may be necessary to lance the abscess or cut out the corn. Wash the wound with a solution made of one part carbolic acid and 50 parts water, then follow with some healing lotion, such as carbolic salve.

Scaly Leg—This disease is caused by a small parasite which burrows under the scales on the fowl's legs. It is contagious in the sense that lousiness is contagious. Cleanse the bird's legs with soapsuds, then dry thoroughly and apply vaseline. Some recommend immersing the bird's feet and legs in a solution made of equal parts coal oil and zenoleum.

Chicken Pox or Sore-Head—This is a contagious disease, which appears as an eruption of yellow nodules about the beak, nostrils, eyes and other parts of the head. After the nodules reach full development they emit a watery discharge, changing later to a thick yellowish matter. Wash all affected parts with carbolized soap, then apply vaseline or glycerine. Sores may also be bathed with soap and water or sponged with solution of copper sulphate, ½ ounce to 1 quart water. Tincture of iodine, sparingly used, may bring about a cure in severe cases.

Apoplexy—This is a disease of the brain caused by a rupture of the blood vessel, and the fowls are usually dead when found. If the bird is still alive pierce the underside of the wing and let it bleed freely.

Leg Weakness—Leg weakness is often hereditary, but may result from improper feeding, especially over-feeding. It is most common in the heavier or long-legged breeds. To prevent it, feed bone-forming substance, such as barley, ground raw bones and meat. A remedy recommended consists of pills composed of phosphate of lime, 5 grains; sulphate of iron, 1 grain; sulphate of quinine, ½ grain; strychnine, 1-15 grain. Of this make a dozen pills and give one each day.

Intestinal Worms—Fowls suffering from intestinal worms become thin, indolent and spiritless. A common remedy is one drop of kerosene oil, night and morning; but it should not be given to very young birds. Powdered areca nut or powdered male fern may be given, followed by castor oil. Of powdered male fern give 30 grains or more, or of the liquid extract, 15 to 30 drops. Chopped up pumpkin seed is good for birds troubled with tapeworms.

Bronchitis, Catarrh and Pip—These diseases are all forms of cold, so that the main thing in treatment is to remove the cause.

FRUIT TREES DO WELL IN THE POULTRY YARD.

Crop Trouble—At the bottom of the gullet is the fowl's crop, in which the food may, from various causes, become stopped. A piece of string or long blade of grass may close the outlet, or soft wheat or corn may form into a hard, swollen mass. The result in such cases is that the bird gets no nutriment, but becomes hungry and eats more and more until the crop assumes enormous proportions. If the crop is filled with grain, moisten with warm water poured down the throat, then hold the bird's head down and work the mass out a little at a time, holding the bird up occasionally so that it may breathe. Follow with sweet oil and soft food. An operation may be necessary. If so, make a small incision. In sewing it up be careful that the crop and outer skin are not sewed together.

Feather Eating—This trouble rarely occurs in flocks that have free range. The habit may be due to an insufficient supply of green food, a shortage of animal matter in food, or too small, over-crowded quarters. A fowl may try to pick an insect off a neighbor, when a feather is accidentally pulled out. If this be a young, growing feather, the blood in the quill end attracts the fowl, and the habit commences.

Egg Eating—Lack of mineral matter in food is given as one reason why hens eat eggs. The principal cause, however, is the accidental breaking of eggs. In this way the hens get started at egg eating. Some recommend catching the culprit and, with a file, removing the sharp end of the beak. Some have tried keeping a china egg in the nest, while others recommend filling an egg shell with mustard. Prevention, though, is easier than cure.

In Missouri more than a Thousand Turkeys are often Delivered in a Single Drove Being Driven in on Foot.

Favus, or White Comb—In this disease the comb looks as if flour had been sprinkled on it, hence the name. The disease often spreads to the head and neck. In severe cases running sores start, a peculiar "mousey" odor is given off, and the feathers are easily pulled out. Saturate the comb with turpentine and rub over with carbolic ointment; or bathe parts, using soap and warm water, then follow with an ointment of 5 per cent nitrate of silver in lard.

Eye Worms—These are small, thread-like worms found beneath the membrane of the eyes of chickens. "The eyeball is likely to be involved, the cornea becomes opaque, and later the entire eyeball is destroyed and the orbital cavity is filled with a yellow purulent material. When this stage is reached, the worms are no longer to be found in the eye. The nostrils may also be affected and become obstructed in the catarrhal process, and finally fatal results may follow. The bird becomes somnolent, scarcely eats, declines in strength, becomes anemic, and dies in three or four weeks. Irrigation of the eyes with a mildly antiseptic solution, such as a 4 per cent boric acid solution or a 1 per cent creolin solution, is indicated, together with irrigation, also, of the nose and mouth, if the nostrils are affected. Anointing the eyes with a mixture of lard 9 parts and iodiform 1 part, or with carbolized vaseline, is likely to give good results in some cases. The general sanitary conditions should also be attended to and stimulating food furnished as in the treatment of simple catarrh."—Bulletin No. 60, United States Department of Agriculture, Bureau of Animal Industry.

A Missouri Crystal White Orpington Hen, First Prize Winner at Jamestown Exposition, and Madison Square Garden, N. Y.

Lice and Mites—Lice and mites are among the poultry raiser's worst enemies, and a continual warfare must be waged against them. They are generally distributed throughout the world wherever chickens are raised. To get rid of body lice provide a dust bath, and make free use of insect powder or tobacco. On young chickens apply grease or oil on head and wings. To destroy mites scald roosts and houses with boiling water, or whitewash thoroughly. A little carbolic acid may be added to the whitewash. A thorough sprinkling and spraying of interior of houses with a mixture of carbolic acid and kerosene is good.

"To keep mites from my fowls I keep the house clean and dust the perches and floor with dry wood ashes once a week."—R. E. Wright.

MISSOURI STATE FAIR FINANCIAL REPORT.

For the year, 1908, giving a summary of the receipts and expenditures.

By John T. Stinson, Secretary, Sedalia.

Receipts.

Balance on hand January 1, 1908	$1,432.16
Miscellaneous items	53.50
Advertising in catalogue	398.00
Hay	362.41
Privileges and concessions	4,535.80
Futurity entry fees	501.15
Rent	70.00
*Stall rent	1,484.25
Exhibitors and wagon tickets	647.25
Association prizes	910.14
Entry fees, suspensions and stall rent, speed department	5,098.95
Admission department	27,152.75
Live stock and agricultural premiums, state appropriation	10,000.00
Transferred from appropriation fund, permanent highway in grounds, to reimburse it for money paid out on permanent roadway	5,000.00
Transferred from appropriation building fund to reimburse receipts fund	97.00
Total	$57,743.36

*Stall rent deducted from premiums to the amount of $438.25.

Expenditures, 1908.

Premiums and speed events	$26,009.24
Painting speed barns	149.62
Stall rent and tickets redeemed	81.50
Collections on suspensions	289.85
Services, press bureau	273.51
Music, two bands	2,274.00
Freight, express and drayage	260.43
Miscellaneous items	479.81
Superintendents, judges and assistants	2,960.71
Furniture and fixtures for office	220.65
Clerical assistance in office	1,115.46
Office supplies	214.63
Janitor s and janitress services fair week	135.00
Police service, including chief	1,044.25
Advertising	1,434 58
Printing, including printing catalogue	1,871.34
Labor on grounds	1,095.10
Expense meetings	1,184.00
Admission department	1,355.94
Permanent roadway	3,224.93
Supplies for grounds	318.73

EXPENDITURES, 1908—Continued.

Livery	$36.25
Sanitation department	105.50
Lumber, improvements and repairs	302.65
Supplies for departments during fair week	121.03
Repairs on buildings	141.11
Postage and stamped envelopes	608.68
Secretary's salary	1,983.57
Expense speed department, excepting superintendent	234.00
Feed for poultry	26.55
Lighting fair grounds during fair week	300.00
Attractions	500.00
Plans, expostion building	350.00
Decorating fair buildings	300.00
Refund checks	17.00
Tents for exhibits on grounds	115.50
Advertising speed events	183.22
Annual dues, American Trotting Association and Association of State Fairs	137.00
Final payments, general contract	793.95
Entertainment, invited guests	95.00
Medical service, emergency hospital	53.05
Janitor for office	50.35
Straw for cattle and horse barns	429.25
City Water Company	350.00
Custodian's salary	860.00
Office rent	340.00
Secretary's traveling expenses	126.67
Telephone and telegrams	133.86
Total	$54,687.47
Total receipts	$57,743.36
Total expenditures	54,687.47
Balance on hand, January 1, 1909	$3,055.89

MISSOURI CROP REVIEW FOR 1908.

The weather conditions for Missouri, during the year 1908, were somewhat unusual, and because of that fact the crops produced were not large. The season, taken as a whole, was very similar to that of the preceding year, and excessive rains during the cultivating season prevented the proper cultivation of crops, destroyed more or less wheat, and greatly reduced the profits of the farmers. However, farm prices were generally higher than for the previous year, particularly for corn. Taken as a whole, the result of the year's work among the farmers was satisfactory.

Corn. The season of 1908 opened up very auspiciously for a large acreage of corn, but later on, excessive rains and overflows reduced the acreage to 89 per cent of the previous year. Practically all of the bottom lands along the Missouri and Mississippi rivers and many of the smaller rivers of the State, were overflowed in June, and the corn crop destroyed. Some of this land was replanted later, but much of this late corn did not produce merchantable corn. The average yield per acre, as given in our corrected returns, is 26 bushels as compared with an average yield one year ago of 32.7 bushels. The greatest falling off in yield this year is in the northwest section, and it should be noted that that is the best corn section of the State. The yield in that section this year, it will be noted, is only 29 bushels as compared with a yield of 39.5 bushels last year. The southwest section shows practically the same yield per acre as last year, but a large reduction in acreage.

The *quality* of the corn, this year, is 81, as compared with 86 for 1907. The quality was affected more by reason of the fact that much of the corn was planted very late and did not have time to mature good, sound corn. The farm price, it should be noted, is not always fixed by the price of corn in the large markets but is governed largely by local conditions. The farm price this year ranged usually from 50 to 60 cents per bushel. In a number of localities, the price ran as high as 75 cents. The average farm price on December 1st, as given by all of our correspondents, was 56 cents per bushel.

By comparison with the report of the United States Department of Agriculture, it will be seen that the yield per acre is practically the same as that estimated by the government, but the total yield is very much less. The difference in the two reports is evidently on account of the government having failed to take into consideration the abandoned area caused by excessive wet weather and overflows, making a large difference in the acreage estimated by the two departments.

The new wheat crop. The drought which prevailed over the State during August and September interfered materially with wheat seeding, and the acreage sown for the crop of 1909 is very considerably reduced below that seeded the year previous. The greatest decrease is in the southeast section where there is a falling off of 20 per cent. The southwest section shows a decrease of 14 per cent, the northwest section 10 per cent, and the central and northeast sections a decrease of only 6 per cent. The total estimated acreage seeded this year is 1,878,000 compared with 1,928,000 one year ago. The condition of the new crop on December 1st was 79, the low condition being caused by dry weather and late seeding. This is 6 points below the condition in 1907 and 10 points below the average for the five years previous.

"The annual mean temperature for the State was 56.7 degrees, or 1.9 degrees above the normal. The highest temperature during the year was 102 degrees, at Warsaw, Benton county, on August 5th, and at Jefferson City, Cole county, on August 15th. The lowest temperature was 10 degrees below zero, at Unionville, Putnam county, on January 30th.

"The average precipitation for the State was 43.68 inches, or 2.97 inches above the normal. The greatest annual amount was 58.27 inches, at Dean, McDonald county, and the least annual amount was 30.78 inches, at Fayette, Howard county. The greatest local monthly fall was 17.07 inches, at Unionville, Putnam county, in May; there was no rain at Albany, Gentry county, in January; Sikeston, Scott county, and Marble Hill, Bollinger county, in October, nor in December at Gallatin, Daviess county, and Linneus, Linn county.

"The average snowfall, unmelted, was 11.8 inches. The greatest annual amount was 30.0 inches, at Willow Springs, Howell county. The greatest monthly fall was 16.5 inches at Lebanon, Laclede county."—Missouri Section, U. S. Department of Agriculture, Climatological Service of the Weather Bureau.

CORN, HAY AND FORAGE.

Table giving acreage, average yield per acre, and total product of corn and of hay and forage, by counties, for the year 1908:

	Corn.			Hay and Forage.	
	Acres planted..	Average yield per acre, bu.	Total yield per county, bu.	Acres........	Total yield per county, tons.
State	6,487,865	26	173,573,422	3,288,111	4,532,019
County.					
Adair	62,720	27	1,693,440	66,645	73,309
Audrain	117,934	28	3,302,152	57,946	69,535
Andrew	70,555	29	2,046,095	30,470	45,705
Atchison	140,884	31	4,367,404	17,880	26,820
Barry	46,658	22	1,026,476	13,950	16,740
Barton	91,494	22	2,012,868	29,760	29,760
Bates	129,449	20	2,588,980	67,600	87,880
Benton	52,361	26	1,361,386	27,100	32,520
Bollinger	28,472	30	854,160	11,325	16,987
Boone	72,501	25	1,812,525	48,700	73,050
Buchanan	68,634	26	1,784,484	20,600	37,080
Butler	20,981	25	524,525	6,600	9,900
Caldwell	80,738	28	2,260,664	45,060	67,590
Callaway	71,448	29	2,071,992	51,440	72,016
Camden	30,164	24	723,936	11,400	66,720
Cape Girardeau	31,271	25	781,775	20,540	36,972
Carroll	123,326	32	3,946,432	49,080	73,620
Carter	9,757	22	214,654	2,320	3,480
Cass	93,433	24	2,242,392	61,150	73,380
Cedar	52,819	28	1,478,932	18,400	22,080
Chariton	53,569	25	1,339,225	55,600	83,400
Christian	41,641	27	1,124,367	13,780	16,536
Clark	78,834	23	1,813,182	47,880	71,820
Clay	65,629	27	1,771,983	20,465	30,697
Clinton	102,095	30	3,062,850	37,040	55,560
Cole	22,324	30	669,720	17,300	25,950
Cooper	75,657	30	2,269,710	24,620	36,930
Crawford	28,615	30	858,450	13,000	15,600
Dade	58,138	22	1,279,036	17,000	20,400
Dallas	45,434	21	954,114	19,200	23,040
Daviess	91,573	31	2,838,763	56,415	78,981
DeKalb	97,805	25	2,445,125	41,635	62,452
Dent	30,888	30	926,640	16,130	24,195
Douglass	36,382	22	800,404	13,250	13,250
Dunklin	42,189	30	1,265,670	5,000	5,000
Franklin	43,241	32	1,383,712	24,000	40,800

CORN, HAY AND FORAGE—Continued.

	Corn.			Hay and Forage.	
	Acres planted.	Average yield per acre, bu.	Total yield per county, bu.	Acres.	Total yield per county, tons.
Gasconade	19,947	32	638,304	12,460	22,428
Gentry	84,615	25	2,115,375	52,495	78,742
Greene	75,423	28	2,111,844	26,400	36,960
Grundy	73,566	35	2,574,810	55,460	83,190
Harrison	130,080	30	3,902,400	80,255	112,357
Henry	99,793	20	1,995,860	45,430	54,516
Hickory	34,651	20	693,020	16,200	19,440
Holt	73,537	30	2,206,110	11,375	19,337
Howard	40,555	30	1,216,650	27,240	43,584
Howell	45,037	25	1,125,925	13,000	13,000
Iron	12,501	25	312,525	8,700	8,700
Jackson	99,869	22	2,197,118	42,175	59,045
Jasper	68,570	25	1,714,250	18,170	27,255
Jefferson	40,872	32	1,307,904	20,140	26,182
Johnson	93,888	23	2,159,424	54,970	82,455
Knox	53,732	25	1,343,300	58,460	75,998
Laclede	32,323	30	969,690	24,100	28,920
Lafayette	104,707	35	3,664,745	35,070	59,619
Lawrence	56,709	20	1,134,180	13,060	16,978
Lewis	48,436	28	1,356,208	48,188	72,282
Lincoln	72,776	30	2,183,280	20,978	31,467
Linn	82,447	30	2,473,410	81,928	106,506
Livingston	91,695	35	3,209,325	50,650	75,975
McDonald	23,524	24	564,576	8,700	8,700
Macon	80,384	31	2,491,904	82,520	107,276
Madison	14,774	28	413,672	10,780	10,780
Maries	25,092	25	627,300	12,200	18,300
Marion	39,289	30	1,178,670	29,989	35,987
Mercer	64,076	35	2,242,660	58,630	70,356
Miller	33,164	25	829,100	16,630	21,619
Mississippi	32,861	30	985,830	4,470	5,364
Moniteau	38,154	30	1,144,620	25,500	33,150
Monroe	86,688	25	2,167,200	54,160	54,160
Montgomery	67,657	26	1,759,082	27,580	27,580
Morgan	36,706	24	880,944	23,520	30,576
New Madrid	39,180	30	1,175,400	2,610	3,915
Newton	35,827	18	644,886	11,000	12,100
Nodaway	178,263	26	4,634,838	56,500	96,050
Oregon	24,230	20	484,600	5,170	5,170
Osage	26,233	32	839,456	14,250	24,225
Ozark	29,331	22	645,282	3,670	3,670
Pemiscot	17,838	32	570,816	960	1,344
Perry	23,018	35	805,630	11,224	16,836
Pettis	96,679	22	2,126,938	45,163	63,228
Phelps	27,249	25	681,225	16,130	24,195
Pike	74,485	33	2,458,005	41,725	62,587

CORN, HAY AND FORAGE—Continued.

	Corn.			Hay and Forage.	
	Acres planted..	Average yield per acre, bu.	Total yield per county, bu.	Acres........	Total yield per county, tons.
Platte........................	52,272	30	1,568,160	15,000	27,000
Polk........................	66,074	21	1,387,554	29,540	35,448
Pulaski......................	27,990	25	699,750	11,800	15,340
Putnam......................	66,381	30	1,991,430	67,760	88,088
Ralls........................	56,079	27	1,514,133	32,000	38,400
Randolph....................	50,875	24	1,221,000	21,650	30,310
Ray.........................	100,687	23	2,315,801	43,760	65,640
Reynolds....................	13,959	23	321,057	8,730	8,730
Ripley......................	22,021	23	506,483	4,580	4,580
Saline......................	148,192	30	4,445,760	36,100	54,150
Schuyler....................	36,631	28	1,025,668	37,000	44,140
Scotland....................	58,411	25	1,460,275	51,430	61,716
Scott.......................	25,179	29	730,191	7,240	8,688
Shannon.....................	19,276	25	481,900	5,230	5,230
Shelby......................	75,850	31	2,351,350	53,865	70,024
Stoddard....................	47,532	25	1,188,300	8,050	12,075
Stone.......................	29,332	25	733,300	7,525	7,525
St. Charles.................	28,981	40	1,159,240	16,800	28,560
St. Clair...................	68,471	21	1,437,891	30,540	39,702
St. Francois................	17,873	25	446,825	15,140	15,140
Ste. Genevieve..............	14,919	25	372,975	9,230	11,076
St. Louis...................	32,393	35	1,133,755	32,060	48,090
Sullivan....................	72,623	27	1,960,821	94,200	141,300
Taney.......................	26,434	25	660,850	3,545	3,545
Texas.......................	48,205	20	964,100	25,200	25,200
Vernon......................	132,562	21	2,783,802	58,770	76,401
Warren......................	20,582	32	658,624	10,130	15,195
Washington..................	25,539	22	561,858	12,340	12,340
Wayne.......................	25,413	28	711,564	10,860	10,860
Webster.....................	34,274	25	856,850	21,630	28,119
Worth.......................	51,837	25	1,295,925	26,040	44,268
Wright......................	32,074	24	769,776	19,400	23,280

WHEAT AND OATS.

Table giving acreage, average yield per acre, and total product of wheat and oats, by counties, for the year 1908:

	Wheat.			Oats.		
	Acreage......	Average yield per acre, bu.	Total yield per county, bu.	Acreage......	Average yield per acre, bu.	Total yield per county, bu.
State........................	1,927,728	10.7	20,684,819	717,286	16	11,901,440
County.						
Adair........................	2,055	13	26,715	3,640	18	65,520
Audrain........................	865	15.5	13,407	22,911	19	435,309
Andrew........................	4,648	17	79,016	5,793	15	86,895
Atchison........................	4,774	16	76,384	22,938	15	344,070
Barry........................	27,439	5	137,195	5,363	20	107,260
Barton........................	12,882	8	103,056	9,760	12	117,120
Bates........................	19,188	11.5	220,662	14,815	14	207,410
Benton........................	11,801	12	141,612	7,463	18	134,334
Bollinger........................	21,773	7	152,411	4,805	15	72,075
Boone........................	17,845	13	231,985	7,236	14	101,304
Buchanan........................	29,509	15.5	457,389	3,993	15	59,895
Butler........................	947	10	9,470	1,434	15	21,510
Caldwell........................	2,301	14	32,214	2,544	15	38,160
Callaway........................	25,528	14	357,392	11,456	19	217,664
Camden........................	5,793	9.5	55,033	3,289	18	59,202
Cape Girardeau..............	48,427	7	338,989	5,841	15	87,615
Carroll........................	22,814	13.5	307,989	6,521	15	97,815
Carter........................	1,369	7	9,583	540	18	9,720
Cass........................	16,808	11.5	193,292	13,163	19	250,097
Cedar........................	8,384	9	75,456	8,635	15	129,525
Chariton........................	20,974	10	209,740	4,125	15	61,875
Christian........................	24,066	7	168,462	4,621	25	115,525
Clark........................	5,258	14.5	76,241	31,567	13	410,371
Clay........................	6,655	13.5	89,842	2,038	18	36,684
Clinton........................	2,272	15	34,080	4,654	17	79,118
Cole........................	35,296	8.5	300,016	3,785	17	64,345
Cooper........................	54,830	12.5	685,375	7,294	12	87,528
Crawford........................	12,977	8	103,816	2,134	17	36,278
Dade........................	20,986	6	125,916	9,485	20	189,700
Dallas........................	9,229	7	64,603	5,991	15	89,865
Daviess........................	5,982	16	95,712	3,139	18	56,502
DeKalb........................	2,130	15	31,950	3,373	16	53,968
Dent........................	14,210	8	113,680	2,060	12	24,720
Douglas........................	15,953	4	63,812	2,689	15	40,335
Dunklin........................	3,331	12	39,972	972	20	19,440
Franklin........................	66,556	11.5	765,394	6,451	25	161,275

WHEAT AND OATS—Continued.

	Wheat.			Oats.		
	Acreage.	Average yield per acre, bu.	Total yield per county, bu.	Acreage.	Average yield per acre, bu.	Total yield per county, bu.
Gasconade	30,027	10.5	315,283	4,346	20	86,920
Gentry	1,613	15	24,195	5,746	15	86,190
Greene	37,495	8	299,960	12,914	22	284,108
Grundy	3,495	10	34,950	3,007	13	39,091
Harrison	2,576	16	41,216	8,762	19	166,478
Henry	29,870	11.5	343,505	13,297	14	186,158
Hickory	6,803	9.5	64,628	4,556	15	68,340
Holt	5,436	16	86,976	14,328	18	257,904
Howard	36,303	13.5	490,090	1,840	18	33,120
Howell	17,172	10	171,720	2,420	13	31,460
Iron	2,080	11	22,880	1,000	18	18,000
Jackson	18,083	13	235,079	5,416	20	108,320
Jasper	51,287	8	410,296	15,199	20	303,980
Jefferson	23,329	11	215,619	2,192	19	41,648
Johnson	31,812	10.5	334,026	8,896	13	115,648
Knox	1,479	14	20,706	48,034	16	768,544
Laclede	4,501	8	36,008	3,965	15	59,475
Lafayette	45,255	12	543,060	10,966	15	164,490
Lawrence	65,189	6	391,134	11,519	20	230,380
Lewis	3,642	17	61,914	6,197	19	117,743
Lincoln	37,349	15.5	578,909	11,314	16	181,024
Linn	3,941	13	51,233	3,564	21	74,844
Livingston	8,072	13	104,936	3,860	16	61,760
McDonald	15,161	6	90,966	1,882	15	28,230
Macon	4,809	13	62,514	3,677	20	73,540
Madison	6,016	8	48,128	1,022	15	15,330
Maries	12,588	8	100,704	2,454	20	49,080
Marion	13,269	15	199,035	2,929	20	58,580
Mercer	1,917	11	21,087	4,917	13	63,921
Miller	12,397	10	123,970	3,885	20	77,700
Mississippi	22,195	14	310,730	140	25	3,500
Moniteau	23,388	10	233,880	6,701	10	67,010
Monroe	8,445	15	126,675	9,530	22	209,660
Montgomery	20,233	15	303,495	14,666	16	234,656
Morgan	13,535	10	135,350	5,278	15	79,170
New Madrid	10,644	15	159,660	293	15	4,395
Newton	32,205	7	225,435	6,713	12	80,556
Nodaway	3,784	14	52,976	20,627	15.5	219,718
Oregon	9,838	7	68,866	2,025	15	30,375
Osage	24,810	10	248,100	2,378	20	47,560
Ozark	8,728	4	34,912	1,471	15	22,065
Pemiscot	5,220	20	104,400	68	20	1,360
Perry	46,748	9	420,732	4,463	20	89,260
ettis	24,574	11.5	282,601	6,219	13	80,847

WHEAT AND OATS—Continued.

	Wheat.			Oats.		
	Acreage......	Average yield per acre, bu.	Total yield per county, bu.	Acreage......	Average yield per acre, bu.	Total yield per county, bu.
Phelps	10,296	8	82,368	4,081	15	61,215
Pike	43,804	16	700,864	12,719	22	279,818
Platte	38,495	15	577,425	2,368	18	42,624
Polk	19,417	9	174,753	10,996	15	164,940
Pulaski	8,715	8	69,720	2,273	14	31,822
Putnam	1,591	14	22,274	6,570	16	105,120
Ralls	9,089	12.5	113,612	6,156	20	123,120
Randolph	2,978	13	38,714	2,900	16	46,400
Ray	9,551	13	124,163	2,633	15	39,495
Reynolds	2,176	8	17,408	790	15	11,850
Ripley	6,246	8	49,968	3,619	15	54,285
St. Charles	50,384	19	957,296	8,678	18	156,204
St. Clair	7,888	9.5	74,936	7,416	15	111,240
Ste. Genevieve	26,367	10	263,670	1,205	19	22,895
St. Francois	11,813	9	106,317	1,375	15	20,625
St. Louis	46,119	11.5	530,368	2,454	15	36,810
Saline	54,678	10.5	574,119	7,505	12	90,060
Schuyler	2,462	14	34,468	5,927	15	88,905
Scotland	1,035	14	14,490	11,330	15	169,950
Scott	50,914	11	560,054	220	20	4,400
Shannon	2,907	7	20,349	823	12	9,876
Shelby	12,361	13.5	166,873	8,343	25	208,575
Stoddard	23,833	10.5	250,246	2,177	24	52,248
Stone	7,753	6	46,518	1,515	19	28,785
Sullivan	691	11	7,601	3,116	17	52,972
Taney	6,312	7	44,184	1,646	12	19,752
Texas	17,357	6	104,142	3,382	13	43,966
Vernon	10,427	9	93,843	11,353	12	136,236
Warren	20,095	12.5	251,187	7,058	16	112,928
Washington	13,017	9	117,153	1,984	13	25,792
Wayne	6,691	9	60,219	1,334	17	22,678
Webster	14,824	8	118,592	5,755	20	115,100
Worth	1,209	15	18,135	3,549	19	67,431
Wright	13,065	6	78,390	2,842	18	51,156

SUMMARY OF THE ACREAGE, YIELD AND VALUE OF FARM CROPS FOR THE YEAR 1908 FOR THE STATE AND BY SECTIONS.

CORN.

Section.	Acres planted.	Average yield per acre, bu.	Total yield, bushels.	Total value.
Northeast	1,280,920	28	36,341,374	$20,480,826
Northwest	1,946,443	29	56,451,067	32,154,790
Central	1,041,321	26	27,578,061	16,184,572
Southwest	1,422,300	22	32,153,720	17,261,403
Southeast	796,881	26	21,049,200	12,526,014
State	6,487,865	26	173,573,422	$98,607,605

WHEAT.

Section.	Acres sown.	Acres harvested.	Average yield per acre, bu.	Total yield bushels.	Total value.
Northeast	263,817	242,857	15.6	3,789,509	$3,605,740
Northwest	243,264	220,571	13.9	3,068,774	2,880,080
Central	448,046	416,862	10.8	4,526,008	4,205,940
Southwest	541,267	497,139	7.7	3,849,301	3,596,200
Southeast	588,549	550,299	9.9	5,451,227	5,224,700
State	2,084,943	1,927,728	10.7	20,684,819	$19,512,660

WHEAT SOWN, FALL, 1908.

Section.	Acreage sown, 1908.	Acreage compared with previous year, per cent.	Average condition crop, Dec. 1, 1908.	Previous five-year average con. Dec. 1, 1908.
Northeast	249,053	94	83	85
Northwest	219,834	90	80	85
Central	427,067	95	80	84
Southwest	466,410	86	85	81
Southeast	515,775	87	68	84
State	1,878,139	90	79	84

OATS.

Section.	Acres harvested.	Average yield per acre, bu.	Total yield, bushels.	Total value.
Northeast	227,926	17	3,927,383	$1,681,900
Northwest	141,172	16	2,270,529	1,069,510
Central	104,674	15	1,607,916	754,850
Southwest	181,945	16	3,035,306	1,306,680
Southeast	61,569	17	1,060,306	515,160
State	717,286	16	11,901,440	$5,328,100

HAY AND FORAGE.

Section.	Acres harvested.	Average yield per acre, ton.	Total yield, tons.	Total value.
Northeast	981,184	1.3	1,275,930	$7,586,540
Northwest	846,055	1.5	1,270,084	7,234,025
Central	546,443	1.5	820,663	5,771,205
Southwest	587,240	1.2	736,680	4,891,950
Southeast	327,189	1.3	428,662	4,340,527
State	3,288,111	1.4	4,532,019	$29,824,247

PRAIRIE HAY.

Section.	Acres sown.	Average yield per acre, tons.	Total yield, tons.	Total value.
Northeast	16,709	1.6	26,734	$106,936
Northwest	33,848	1.4	47,387	236,935
Central	15,496	1.	15,496	77,480
Southwest	99,679	1.	99,679	498,395
Southeast	2,213	1.	2,213	15,491
State	167,945	1.2	191,509	$935,237

SUMMARY OF TOTAL YIELD AND TOTAL VALUE OF FARM CROPS PRODUCED BY MISSOURI FARMERS IN THE YEAR 1908.

	Acreage.	Yield.	Total farm value.
Corn	6,487,865	173,573,422	$98,607,605
Wheat	1,927,728	20,684,819	19,512,660
Oats	717,286	11,901,440	5,328,100
Hay and Forage	3,288,111	4,532,019	29,824,247
Prairie Hay	167,945	191,509	935,237
Flax	20,000	140,000	138,600
Rye	15,000	180,000	142,200
Buckwheat	1,919	23,025	21,413
Barley	1,750	36,750	25,725
Broomcorn	4,000	1,400,000	42,000
Cotton	76,668	27,983,820	2,378,625
Potatoes	74,783	6,431,338	4,501,936
Tobacco	2,471	2,038,575	244,629
Sorghum Seed	25,043	425,731	353,356
Sorghum Syrup	25,043	2,129,080	894,200
Clover Seed	60,300	84,420	506,520
Timothy Seed	75,500	264,250	528,500
Kaffir Corn, Millet, cowpeas, castor beans, etc.			1,080,000
Miscellaneous vegetables			6,750,000
Total value of all crops			$171,815,553

CROP YIELDS, 1908.

AVERAGE PER ACRE BY CROP SECTIONS.

Crop.	N. E. Sec. 20 counties.	N. W. Sec. 21 counties.	Cent. Sec. 21 counties.	S. W. Sec. 23 counties.	S. E. Sec. 29 counties.	Whole State, 114 counties.
Corn, bushels	28	29	26	22	26	26
Wheat, bushels	15.6	13.9	10.8	7.7	9.9	10.7
Oats, bushels	17	16	15	16	17	16
Hay — Timothy, tons	1.3	1.5	1.5	1.2	1.3	1.4
Hay — Prairie, tons	1.6	1.4	1	1	1	1.2
Hay — Clover, tons	1.7	1.6	1.5	1.4	1.4	1.5
Hay — Alfalfa, tons	2.5	3	2.5	2	2.6	2.6
Hay — Cowpea, tons	1.6	1.8	1.5	1.6	1.5	1.6
Flax, bushels						7
Rye, bushels	11.5	14	11.4	10	10.7	12
Buckwheat, bushels	16	15	12	9	10	12
Barley, bushels						21
Broomcorn, lbs	700		175	425	100	350
Cotton (lint), pounds						365
Potatoes, bushels	94	104	88	70	74	86
Tobacco, pounds						825
Sorghum syrup, gallons	80	107	83	69	89	85
Sorghum seed, bushels	16	17	22	15	17	17
Kaffir corn, bushels	23	24	26	22	15	22
Cowpeas, bushels	12	11	14	12	17	13
Clover seed, bushels	1.9	2	1.8	1.7	1.5	1.4
Timothy seed, bushels	3.4	4	4	3.4	3	3.5

AVERAGE FARM PRICE, NOVEMBER 1, 1908.

The prices given in this table are governed by local conditions and are the current local prices prevailing in the country.

	N. E.	N. W.	Central.	S. W.	S. E.	State.
Corn, per bushel	$ .56	$ .57	$ .58	$ .53	$ .59	$ .56
Wheat, per bushel	.95	.93	.92	.93	.95	.94
Oats, per bushel	.42	.47	.47	.43	.48	.44
Flax, per bushel	....	.96	1.00	1.00	....	.99
Timothy seed, per bu	1.70	2.00	2.30	2.70	2.00	2.00
Clover seed, per bushel	6.00	6.00	6.00	7.00	6.00	6.00
Cowpea seed, per bushel	1.60	2.00	1.60	2.00	1.40	1.80
Sorghum seed, per bushel	.67	.75	.93	.82	1.00	.83
Kaffir Corn, per bu	1.00	.58	.87	.69	1.00	.83
Rye, per bushel	.70	.73	.84	.84	.85	.80
Buckwheat, per bushel	.88	.86	.95	.98	.98	.93
Barley, per bushel	.70	.60	.90	....	.61	.70
Potatoes, per bushel	.65	.67	.67	.75	.76	.70
Sweet potatoes, per bushel	.93	1.00	.85	.82	.78	.87
Winter apples, per bushel	.95	.66	.98	.93	.93	.89
Timothy hay, per ton	5.00	5.70	7.30	6.60	10.00	6.50
Clover hay, per ton	6.30	5.50	7.00	6.60	8.70	7.00
Alfalfa hay, per ton	7.60	8.50	8.50	8.00	10.00	8.60
Cowpea hay, per ton	8.00	4.00	7.00	6.00	8.00	6.60
Prairie hay, per ton	4.00	5.00	5.00	5.00	7.00	5.00
Broomcorn brush, per ton	70.00	70.00	60.00	77.00	60.00	67.00
Cotton lint, per lb	....	....	....	.09	.08	.085
Leaf tobacco, per lb	.11	.14	.13	.12	.12	.12
Wool, per lb	.18	.17	.18	.18	.22	.19

LIVE STOCK—AVERAGE FARM PRICE PER HEAD, DECEMBER 1, 1908.

	N. E. Sec.	N. W. Sec.	Cent. Sec.	S. W. Sec.	S. E. Sec.	State.
Horses.						
Spring colts	$48.	$51.	$44.	$50.	$42.	$47.
Yearlings	73.	76.	64.	67.	62.	68.
Two years and over	103.	110.	92.	91.	92.	97.
Mules.						
Spring colts	59.	64.	57.	57.	52.	58.
Yearlings	85.	92.	82.	82.	75.	83.
Two years and over	118.	133.	116.	112.	111.	118.
Cattle.						
Steer calves	15.	14.	13.	10.	8.	12.
Heifer calves	12.	11.	10.	8.	7.	10.
Yearling steers	23.	23.	20.	18.	13.	19.
Yearling heifers	18.	18.	15.	16.	12.	16.
Steers, 2 years and over	34.	34.	29.	27.	20.	29.
Cows, 2 years and over	35.	38.	33.	32.	27.	33.
Sheep.						
Lambs under 1 year	3.4	3.9	3.	3.6	3.3	3.4
All other sheep	4.5	4.7	4.	4.4	3.7	4.
Chickens.						
Average price per lb	.08	.07	.07	.07	.07	.07
Turkeys.						
Average price per lb	.12	.12	.10	.10	.10	.11

LIVE STOCK—CONDITION AS TO THRIFT AND HEALTH, DEC. 1, 1908.

	N. E. Sec.	N. W. Sec.	Cent. Sec.	S. W. Sec.	S. E. Sec.	State.
Cattle	97	97	95	95	94	95
Horses	96	97	95	96	93	95
Mules	96	98	97	97	95	96
Hogs	91	83	90	91	86	88
Sheep	92	96	90	90	90	91

MISSOURI LIVE STOCK.

An abstract of the assessment of horses and mules as shown by the assessors' returns June 1, 1907. (Compiled from reports of State Auditor.)

County.	Horses.			Mules.		
	No.	Valuation.	Valuation per head.	No.	Valuation.	Valuation per head.
Adair	8,926	$330,985	$37.08	905	$34,795	$38 45
Andrew	7,845	321,195	40 94	1,810	95,975	53 02
Atchison	7,911	266,755	33 72	2,610	97,280	37 27
Audrain	9,567	359,200	37 43	3,627	157,695	43 47
Barry	8,660	278,503	32 15	2,374	77,030	32 85
Barton	8,769	241,038	27 49	2,195	65,660	29 91
Bates	14,033	469,537	33 45	3,046	109,850	35 63
Benton	7,377	234,835	31 83	1,987	75,650	38 07
Bollinger	3,182	183,171	57 56	2,317	102,941	44 43
Boone	9,392	337,425	35 92	4,364	168,675	38 67
Buchanan	9,326	319,760	34 28	2,515	98,850	39 20
Butler	3,305	119,775	36 02	1,373	50,565	36 74
Caldwell	7,582	235,935	31 11	1,505	52,167	34 66
Callaway	9,858	262,035	26 58	4,647	173,215	37 27
Camden	4,976	258,180	51 85	1,484	86,295	58 15
Cape Girardeau	6,373	216,405	32 37	2,722	99,485	36 51
Carroll	11,865	402,855	33 95	4,149	163,500	39 40
Carter	1,095	57,617	52 61	633	37,066	58 55
Cass	11,949	389,962	32 63	2,826	92,905	32 87
Cedar	7,842	269,096	34 31	1,931	78,048	40 41
Chariton	11,654	408,985	35 09	3,089	128,711	41 66
Christian	6,423	265,043	41 26	1,712	76,464	44 66
Clark	7,019	255,705	36 43	910	36,965	40 62
Clay	7,071	265,310	37 52	1,470	71,865	48 88
Clinton	6,198	196,140	31 64	1,562	71,095	45 51
Cole	3,109	94,955	30 54	1,278	36 890	28 84
Cooper	8,422	373,430	44 34	4,676	291,750	62 39
Crawford	3,382	130,585	38 61	1,519	65,155	42 81
Dade	6,397	230,124	35 97	1,909	87,369	45 76
Dallas	5,877	153,600	26 13	1,403	36,705	26 16
Daviess	11,820	376,416	31 84	2,382	84,655	35 53
DeKalb	7,485	241,548	32 27	1,470	52,368	35 63

MISSOURI LIVE STOCK—Continued.

County.	Horses.			Mules.		
	No.	Valuation.	Valuation per head.	No.	Valuation.	Valuation per head.
Dent	4,583	$191,820	$41 85	1,536	$76,602	$49 87
Douglas	5,359	242,615	47 14	895	44,920	50 19
Dunklin	4,433	200,465	45 22	3,750	220,470	58 79
Franklin	6,224	208,285	33 46	2,800	100,635	35 90
Gasconade	3,294	105,440	32 00	1,959	70,021	35 74
Gentry	10,269	376,900	36 70	1,221	45,210	37 02
Greene	13,640	440,280	32 28	3,521	135,190	38 40
Grundy	7,961	239,287	30 05	1,785	37,630	21 08
Harrison	14,877	440,304	29 59	1,640	48,189	29 38
Henry	11,218	343,547	30 62	3,300	105,561	31 99
Hickory	5,401	201,606	37 32	1,321	58,355	44 17
Holt	6,689	253,160	37 86	1,705	82,560	48 42
Howard	5,738	160,810	28 02	3,280	119,745	36 50
Howell	6,198	219,132	35 35	1,706	67,464	39 54
Iron	1,839	73,357	39 89	844	40,220	47 65
Jackson	22,140	864,990	39 07	3,198	169,685	53 06
Jasper	17,374	571,286	32 30	1,988	83,550	42 00
Jefferson	5,825	169,405	29 08	2,446	87,415	35 73
Johnson	14,370	498,780	34 70	4,333	183,985	42 46
Knox	7,448	273,840	36 76	1,357	48,700	35 88
Laclede	5,986	232,585	38 85	1,660	62,375	37 57
Lafayette	11,826	424,625	36 75	4,770	220,780	46 28
Lawrence	9,559	284,549	29 76	2,848	98,999	34 76
Lewis	6,493	256,260	39 46	1,460	58,140	39 84
Lincoln	6,254	174,220	27 85	1,730	53,110	30 69
Linn	10,725	316,756	29 53	1,794	53,335	29 73
Livingston	10,317	343,107	33 25	1,683	62,402	37 08
McDonald	4,922	183,290	37 24	997	44,053	44 18
Macon	12,569	463,425	36 87	2,734	107,175	39 20
Madison	2,317	87,015	37 55	1,311	58,921	44 94
Maries	3,412	102,386	30 00	2,020	72,869	36 07
Marion	7,215	253,145	35 08	1,262	54,560	43 23
Mercer	8,756	331,930	37 90	850	30,580	35 98
Miller	6,179	214,730	34 75	1,877	76,715	40 87
Mississippi	2,455	85,435	34 80	4,099	184,670	45 05
Moniteau	5,587	176,435	31 58	2,150	84,890	39 48
Monroe	9,479	359,550	37 85	3,592	141,000	36 47
Montgomery	5,293	172,555	32 60	2,041	87,915	43 07
Morgan	5,879	143,900	24 50	2,193	61,910	28 23
New Madrid	2,311	64,280	27 81	3,906	109,740	28 09
Newton	9,956	227,330	22 83	1,438	35,505	24 69
Nodaway	17,235	563,355	32 69	2,108	65,445	31 00
Oregon	4,233	100,109	23 64	1,898	49,863	26 27
Osage	3,697	121,040	33 55	2,480	121,715	49 08
Ozark	4,679	219,898	44 85	1,357	74,588	54 96
Pemiscot	2,295	67,100	29 23	3,187	115,730	36 31
Perry	4,718	157,938	33 47	2,646	98,152	37 09
Pettis	11,498	369,050	32 10	3,648	168,675	46 35

MISSOURI LIVE STOCK—Continued.

County.	Horses.			Mules.		
	No.	Valuation.	Valuation per head.	No.	Valuation.	Valuation per head.
Phelps	4,186	$138,694	$33 13	1,350	$53,698	$39 77
Pike	7,449	287,320	43 70	2,173	89,980	41 40
Platte	5,817	220,660	37 93	2,459	109,165	44 39
Polk	10,426	368,990	35 00	2,959	111,363	37 63
Pulaski	3,393	93,550	27 57	820	28,355	34 58
Putnam	9,916	280,529	28 29	1,187	29,610	24 94
Ralls	5,023	198,495	39 55	1,314	54,435	41 42
Randolph	8,058	293,980	36 48	1,769	73,231	41 38
Ray	9,777	308,005	31 50	3,408	136,925	40 17
Reynolds	2,593	118,976	45 88	1,401	80,903	57 73
Ripley	3,381	164,803	48 66	1,431	80,544	56 28
St. Charles	7,718	328,690	42 58	2,556	128,765	50 37
St. Clair	8,773	261,610	30 00	2,441	51,670	21 16
St. Francois	3,657	90,605	24 77	1,332	57,285	43 00
Ste. Genevieve	3,447	94,635	27 45	1,110	47,990	43 23
St. Louis	8,832	449,960	50 94	3,672	190,040	51 75
St. Louis City	10,820	370,920	34 28	765	31,450	41 11
Saline	9,819	384,215	39 12	5,662	295,680	52 22
Schuyler	6,185	210,375	34 00	808	30,463	37 70
Scotland	7,517	257,870	34 30	974	36,100	37 06
Scott	3,231	107,790	33 45	4,199	159,443	37 97
Shannon	2,977	118,026	39 64	1,309	63,793	48 73
Shelby	9,037	311,490	34 46	2,648	89,665	33 86
Stoddard	6,967	327,478	47 00	3,866	218,092	56 41
Stone	4,271	160,102	37 48	1,027	44,831	43 63
Sullivan	11,757	350,347	29 79	1,364	39,411	28 87
Taney	3,702	152,067	41 07	983	45,103	45 88
Texas	8,450	332,725	39 37	2,291	95,040	41 48
Vernon	13,276	356,391	26 84	2,816	95,316	33 84
Warren	3,081	98,430	31 94	1,174	49,465	42 13
Washington	3,209	91,440	28 49	1,590	51,805	32 58
Wayne	3,538	134,410	38 00	2,050	90,745	44 21
Webster	6,360	231,575	36 41	1,825	73,755	40 41
Worth	5,863	193,420	32 97	496	14,990	30 22
Wright	7,184	289,506	40 29	1,732	73,860	42 64
State	845,108	$29,295,461	$34 66	250,045	$10,160,496	$40 63

MISSOURI LIVE STOCK—Continued.

An abstract of the Assessment of Asses and Jennets and Neat Cattle as shown by the Assessors' Returns June 1, 1907. (Compiled from reports of State Auditor.)

County.	Asses and Jennets.			Neat Cattle.		
	No.	Valuation.	Valuation. per head.	No.	Valuation.	Valuation per head.
Adair	63	$3,650	$57 94	23,852	$273,910	$11 48
Andrew	103	9,925	96 33	24,256	345,925	14 26
Atchison	49	4,580	93 47	36,225	627,190	17 31
Audrain	199	11,650	58 54	21,294	300,510	14 11
Barry	150	5,550	37 00	17,717	151 310	8 54
Barton	105	5,130	48 85	18,340	177,497	9 18
Bates	131	8,026	61 26	30,958	314,755	10 10
Benton	96	5,265	54 85	21,709	246,605	11 31
Bollinger	55	3,330	60 54	14,512	106,527	7 34
Boone	207	8,910	43 04	19,569	290,210	14 83
Buchanan	64	3,800	59 37	15,522	243,345	15 68
Butler	33	900	27 27	13,676	103,101	7 54
Caldwell	73	3,950	54 10	20,828	269,968	12 96
Callaway	318	20,045	63 05	16,852	239,495	14 21
Camden	60	3,875	64 58	18,909	247,520	13 09
Cape Girardeau	77	6,415	83 31	11,679	103,895	8 90
Carroll	99	4,945	49 94	23,435	306,852	13 09
Carter	22	1,165	54 95	5,713	53,875	9 43
Cass	118	8,750	74 15	26,165	304,576	11 64
Cedar	78	7,630	99 73	17,135	201,919	11 74
Chariton	105	9,220	87 80	23,688	329,983	13 94
Christian	117	5,760	49 23	16,277	176,345	10 83
Clark	15	1,250	83 33	15,809	200,745	12 70
Clay	72	9,885	137 30	21,024	333,690	15 87
Clinton	39	2,840	72 82	24,101	384,895	15 97
Cole	34	1,765	51 91	8,574	92,505	10 78
Cooper	117	14,350	122 65	17,358	264,400	15 23
Crawford	35	2,025	58 14	12,380	149,295	12 05
Dade	104	6,021	57 90	15,700	159,702	10 17
Dallas	55	3,480	63 27	13,167	109,002	8 27
Daviess	126	11,690	92 77	26,375	360,233	13 65
DeKalb	53	4,525	85 37	24,125	300,787	12 46
Dent	72	3,050	42 36	16,379	166,976	10 19
Douglas	55	4,072	74 03	13,963	168,592	12 07
Dunklin	30	2,045	68 16	14,370	116,710	8 12
Franklin	31	1,710	55 16	12,218	174,310	14 26
Gasconade	21	1,023	48 71	9,595	95,090	9 91
Gentry	107	6,595	61 64	28,484	401,655	14 10
Greene	102	5,605	54 95	23,539	267,556	11 37
Grundy	121	5,985	49 46	22,357	260,937	11 22
Harrison	99	9,555	96 51	43,899	579,282	13 19
Henry	83	4,111	49 53	26,045	287,012	11 02
Hickory	65	5,195	78 38	15,422	178,408	11 56
Holt	41	2,780	67 80	14,375	224,590	15 62

MISSOURI LIVE STOCK—Continued.

County.	Asses and Jennets.			Neat Cattle.		
	No.	Valuation.	Valuation per head.	No.	Valuation.	Valuation per head.
Howard	113	$6,810	$60 26	14,150	$227,900	$16 10
Howell	82	3,385	41 28	15,244	165,647	10 87
Iron	20	975	48 75	6,675	66,408	9 95
Jackson	....	....	....	24,602	363,975	14 79
Jasper	109	6,545	60 00	19,774	247,607	12 50
Jefferson	50	3,050	61 00	15,082	131,549	8 72
Johnson	150	8,740	58 26	31,420	420,410	13 38
Knox	74	3,865	52 22	18,871	257,890	13 66
Laclede	101	3,840	38 02	15,900	202,545	12 73
Lafayette	77	6,090	79 00	25,124	342,435	13 67
Lawrence	81	4,135	51 04	15,229	158,249	10 39
Lewis	56	5,375	96 00	15,062	193,960	12 87
Lincoln	62	2,270	36 61	13,801	184,895	13 39
Linn	90	6,625	73 61	34,471	342,635	9 94
Livingston	54	3,640	67 40	22,309	252,980	11 33
McDonald	101	3,470	34 35	10,543	101,155	9 60
Macon	151	8,980	59 47	29,623	401,035	13 53
Madison	22	1,805	82 00	8,159	72,759	8 80
Maries	42	1,750	41 66	14,050	106,486	7 57
Marion	43	4,570	106 30	11,710	174,450	14 89
Mercer	70	4,075	58 21	26,285	452,987	17 02
Miller	45	3,715	80 33	17,749	175,520	9 89
Mississippi	33	1,475	44 70	7,753	63,605	8 20
Moniteau	86	4,850	56 39	12,702	136,755	10 76
Monroe	179	10,680	59 66	20,089	290,900	14 48
Montgomery	89	7,425	83 42	14,289	171,700	12 01
Morgan	112	3,180	28 39	13,627	115,300	8 46
New Madrid	22	840	38 18	9,506	49,640	5 22
Newton	80	1,930	24 12	15,180	130,510	8 59
Nodaway	98	4,020	41 00	56,458	527,131	9 34
Oregon	43	1,040	24 18	15,655	128,218	8 19
Osage	36	2,255	62 08	11,521	115,030	9 98
Ozark	62	3,762	60 67	22,068	222,620	10 09
Pemiscot	30	760	25 33	10,894	60,589	5 56
Perry	52	2,390	46 00	8,803	85,332	9 69
Pettis	123	5,760	46 83	27,756	400,155	14 41
Phelps	50	2,030	40 60	14,254	141,695	9 93
Pike	264	13,330	50 49	14,358	184,480	12 85
Platte	105	6,670	64 47	12,135	160,715	13 24
Polk	218	12,600	57 79	20,169	247,580	12 22
Pulaski	28	1,045	37 33	12,275	125,790	10 24
Putnam	52	2,120	40 76	31,395	419,658	13 36
Ralls	62	3,610	59 83	10,763	149,555	13 90
Randolph	138	8,860	64 20	15,234	221,465	14 53
Ray	128	9,315	72 77	19,005	306,215	16 11
Reynolds	19	1,090	57 36	14,259	129,650	9 00
Ripley	50	2,150	43 00	12,992	121,902	9 38
St. Charles	45	2,520	56 00	12,308	160,560	13 04

MISSOURI LIVE STOCK—Continued.

County.	Asses and Jennets.			Neat Cattle.		
	No.	Valuation.	Valuation per head.	No.	Valuation.	Valuation per head.
St. Clair	80	$3,660	$15 75	21,639	$239,005	$11 04
St. Francois	22	1,760	80 00	9,135	94,415	13 35
Ste. Genevieve	35	2,355	67 28	7,534	77,745	10 32
St. Louis	....	....	....	10,489	171,600	16 36
St. Louis City	....	....	....	5,980	88,640	14 82
Saline	158	9,295	58 83	34,219	494,665	14 45
Schuyler	37	1,730	46 75	14,457	171,675	11 87
Scotland	92	3,680	40 00	21,462	277,470	12 92
Scott	12	1,230	102 50	7,404	65,345	8 82
Shannon	24	1,805	75 20	13,977	128,469	9 19
Shelby	138	9,475	68 66	17,758	257,505	14 50
Stoddard	53	3,530	66 60	22,061	153,863	6 97
Stone	53	2,243	42 32	12,162	123,588	10 62
Sullivan	117	5,785	49 44	34,726	475,551	13 69
Taney	82	2,765	33 71	16,346	168,356	10 29
Texas	156	8,175	52 41	25,560	261,440	10 22
Vernon	176	8,874	50 42	29,606	304,498	10 28
Warren	17	1,985	116 76	7,653	66,900	8 74
Washington	43	1,800	41 86	12,826	126,770	9 88
Wayne	27	1,330	49 25	15,219	107,855	7 08
Webster	166	6,275	37 80	15,141	154,710	10 22
Worth	24	1,710	71 25	18,886	331,010	17 53
Wright	98	5,497	56 09	18,448	205,167	11 12
State	9,206	$546,504	$59 36	2,091,559	$25,148,134	$12 02

An abstract of the Assessment of Sheep, Hogs and all other live stock as shown by the Assessors' Returns June, 1, 1907. (Compiled from reports of State Auditor.)

County.	Sheep.			Hogs.		
	No.	Valuation.	Valuation per head.	No.	Valuation.	Valuation per head.
Adair	7,559	$11,435	$1 51	10,453	$40,535	$3 88
Andrew	5,071	12,190	2 40	31,826	181,760	5 71
Atchison	1,033	2,055	1 99	46,492	132,750	2 85
Audrain	21,374	37,770	1 81	27,282	94,725	3 47
Barry	4,776	7,134	1 49	23,285	34,758	1 49
Barton	2,170	2,783	1 27	17,171	41,004	2 38
Bates	6,642	13,964	2 10	39,655	124,751	3 14
Benton	6,261	10,645	1 70	18,115	54,895	3 03
Bollinger	19,400	16,881	.87	22,118	34,623	1 56
Boone	12,014	30,725	2 55	24,896	65,960	2 65
Buchanan	4,008	8,063	2 01	21,116	62,342	2 95
Butler	1,060	1,270	1 19	17,263	21,025	1 21
Caldwell	9,959	24,807	2 49	27,010	75,042	2 77
Callaway	23,465	46,275	1 97	18,206	60,990	3 35
Camden	13,186	26,385	2 00	20,067	53,650	2 67
Cape Girardeau	6,506	11,955	1 84	22,653	44,760	1 97

MISSOURI LIVE STOCK—Continued.

County.	Sheep.			Hogs.		
	No.	Valuation.	Valuation per head.	No.	Valuation.	Valuation per head.
Carroll	8,127	$15,027	$1 84	32,951	$85,118	$2 58
Carter	754	1,060	1 40	10,618	12,419	1 17
Cass	6,835	13,325	1 94	41,127	136,414	3 31
Cedar	4,005	9,091	2 26	26,243	54,782	2 08
Chariton	15,462	41,075	2 66	25,453	78,902	3 10
Christian	9,420	16,807	1 76	26,036	45,718	1 75
Clark	7,925	15,445	1 95	9,112	40,415	4 43
Clay	13,640	33,275	2 44	28,370	106,680	3 76
Clinton	3,585	8,577	2 39	26,366	75,492	2 86
Cole	2,508	2,890	1 15	11,163	16,635	1 49
Cooper	8,040	20,320	2 52	34,191	104,650	3 06
Crawford	6,865	14,040	2 04	13,426	28,110	2 09
Dade	5,715	13,705	2 40	16,157	47,436	2 93
Dallas	8,081	10,405	1 28	16,055	21,925	1 37
Daviess	17,818	38,320	2 15	37,396	106,017	2 83
DeKalb	6,967	19,123	2 74	28,793	91,552	3 17
Dent	7,508	11,459	1 52	23,552	37,449	1 59
Douglas	10,334	24,684	2 38	15,187	33,592	2 21
Dunklin	298	350	1 17	23,623	42,538	1 80
Franklin	3,932	8,050	2 04	17,761	52,170	2 93
Gasconade	3,091	6,239	2 01	10,910	22,223	2 03
Gentry	10,294	17,299	1 68	28,908	94,870	3 28
Greene	7,752	12,244	1 63	28,427	60,591	2 14
Grundy	15,008	27,640	1 84	18,499	53,078	2 86
Harrison	15,242	51,771	3 39	40,208	147,568	3 42
Henry	4,560	6,612	1 45	30,138	87,898	2 91
Hickory	5,535	12,741	2 30	15,604	35,100	2 24
Holt	1,236	3,420	2 76	25,711	131,330	5 10
Howard	7,296	16,450	2 25	16,205	53,640	3 31
Howell	6,984	7,610	1 08	22,821	26,050	1 14
Iron	1,658	2,946	1 77	7,583	9,987	1 31
Jackson	8,781	18,876	2 15	41,634	119,576	2 87
Jasper	2,059	4,168	2 00	16,804	51,732	3 20
Jefferson	2,209	3,335	1 51	15,415	35,214	2 22
Johnson	13,970	24,755	1 77	40,031	130,990	3 27
Knox	10,490	13,210	1 25	15,390	43,230	2 80
Laclede	9,936	17,900	1 80	16,191	37,480	2 31
Lafayette	9,791	12,130	1 24	33,001	113,610	3 44
Lawrence	4,775	6,577	1 37	21,979	48,399	2 20
Lewis	7,418	22,295	3 00	13,159	49,320	3 74
Lincoln	5,094	10,112	1 98	18,475	41,608	2 25
Linn	14,114	21,056	1 49	20,048	55,182	2 75
Livingston	10,418	20,302	1 94	29,748	74,400	2 53
McDonald	5,343	7,790	1 45	17,032	36,340	2 13
Macon	11,719	21,075	1 79	19,015	54,980	2 89
Madison	2,753	4,141	1 50	9,534	12,787	1 33
Maries	7,781	7,781	1 00	20,531	20,531	1 00
Marion	10,809	26,095	2 41	11,442	46,920	4 10

MISSOURI LIVE STOCK—Continued.

County.	Sheep.			Hogs.		
	No.	Valuation.	Valuation per head	No.	Valuation.	Valuation per head.
Mercer	8,021	$22,701	$2 83	18,626	$71,419	$3 82
Miller	8,598	14,185	1 65	25,043	48,095	1 92
Mississippi	143	145	1 01	13,901	26,011	1 87
Moniteau	3,435	8,025	2 33	15,828	40,465	2 64
Monroe	29,462	51,970	1 76	24,339	66,080	2 71
Montgomery	6,472	13,055	2 01	19,480	58,800	3 01
Morgan	6,480	9,190	1 40	13,290	25,870	1 95
New Madrid	460	460	1 00	13,440	13,440	1 00
Newton	1,599	1,630	1 01	13,057	27,445	2 10
Nodaway	7,707	8,910	1 15	63,015	177,234	2 81
Oregon	3,800	3,800	1 00	28,166	28,166	1 00
Osage	3,716	5,513	1 48	16,759	33,467	2 00
Ozark	4,746	9,368	1 97	18,740	29,779	1 59
Pemiscot	75	82	1 09	15,340	28,524	1 85
Perry	7,197	9,078	1 26	27,215	35,562	1 30
Pettis	9,616	18,825	1 96	29,192	91,140	3 12
Phelps	6,361	7,692	1 21	17,054	23,933	1 40
Pike	7,888	16,190	2 05	18,920	57,320	3 03
Platte	6,653	15,845	2 38	22,274	68,440	3 07
Polk	12,327	25,103	2 03	30,467	74,940	2 45
Pulaski	7,940	8,205	1 03	15,560	16,565	1 06
Putnam	9,746	11,970	1 22	13,969	36,302	2 59
Ralls	10,698	18,505	1 72	10,423	34,845	3 24
Randolph	10,571	23,535	2 22	8,236	31,590	3 83
Ray	4,624	8,490	1 83	35,940	119,035	3 03
Reynolds	2,733	2,770	1 02	21,230	22,023	1 03
Ripley	2,744	4,396	1 60	17,983	25,567	1 42
St. Charles	3,345	8,280	2 47	21,983	64,195	2 92
St. Clair	3,372	6,025	1 78	20,062	65,595	3 27
St. Francois	1,392	3,245	2 33	6,980	15,480	2 22
Ste. Genevieve	3,924	4,895	1 24	10,872	22,435	2 06
St. Louis	892	1,960	2 20	12,991	47,650	3 67
Saline	5,973	11,530	1 93	40,061	122,130	3 05
Schuyler	32,070	47,920	1 49	8,109	23,676	2 91
Scotland	8,003	13,815	1 72	12,932	38,785	2 99
Scott	630	755	1 18	19,538	20,534	1 05
Shannon	2,678	2,870	1 07	20,352	24,477	1 20
Shelby	15,670	29,890	1 90	18,437	65,080	3 52
Stoddard	2,030	2,070	1 02	34,710	34,717	1 00
Stone	4,726	6,899	1 46	17,127	20,923	1 28
Sullivan	13,428	23,875	1 75	16,503	44,621	2 70
Taney	3,405	5,371	1 57	17,506	20,523	1 17
Texas	15,567	25,100	1 61	34,230	41,190	1 20
Vernon	2,754	4,123	1 49	28,860	74,078	2 56
Warren	1,957	3,485	1 80	10,390	30,830	2 96
Washington	3,038	3,717	1 22	8,442	12,320	1 45
Wayne	3,011	4,245	1 40	22,123	29,205	1 32
Webster	10,585	18,696	1 76	19,519	33,920	1 73
Worth	4,607	9,790	2 13	13,569	78,670	5 80
Wright	17,277	34,905	2 02	23,753	41,306	1 73
State	852,548	$1,581,034	$1 85	2,462,163	$6,320,595	$2 56

ANNUAL REPORT OF DR. D. F. LUCKEY, STATE VETERINARIAN, FOR THE YEAR DECEMBER 17, 1907, TO DECEMBER 17, 1908.

Owner.	Postoffice.	How called.	Date.	Kind of stock.	Disease.	How disposed of.
Chas. Weiblen	3444 S. Compton, st., St. Louis, Mo	Dr. A. J. Hammerstein	Jan. 17	1 grey gelding	Glanders	Quarantined.
Theodore Funk	Warrensburg, Mo	Dr. J. H. McLevey	Feb. 16	30 cattle	Malignant catarrh	
David Nichols	Warrensburg, Mo	Dr. J. H. McLevey	Feb. 16	60 cattle	Malignant catarrh	
Mrs. Miller	St. Louis, Mo	Dr. A. J. Hammerstein	Feb. 20	1 horse	Glanders	Dead.
Joseph Fountain	Sturgeon, Mo	Petition	Feb. 27	8 sheep	Pneumonia	
Frank Hanses	3756 S. Broadway, St. Louis, Mo	Dr. Jno. E. Clem	Feb. 28	1 bay gelding	Glanders	Killed privately.
F. C. Hohlier	Joplin, Mo		Mar. 18	46 cows	Tuberculosis	Quarantined.
L. M. Drake	Joplin, Mo		Mar. 18	46 cows	Tuberculosis	Quarantined.
Disher Hoop & Lumber Co.	Dexter, Mo	Personal request	Apr. 16	1 bay gelding	Glanders	Quarantined.
Mitchell, Payton,	Patterson, Mo	T. M. Polk	Apr. 16	1 black mule	Glanders	Quarantined.
J. W. Risner	Couch, Mo	Return visit	Apr. 22		None	
Herman Qumken	3111a Penn. ave., St. Louis, Mo	Return visit	Apr. 24	1 black mule	Glanders	Quarantined.
John Dannacker	Clayton, Mo	Dr. Krumrey	May 3	1 black mare	Glanders	Quarantined.
Ennis Bros	Horine, Mo	Personal request	May 4	5 cattle	Tuberculosis	Quarantined.
J. W. Pickel	St. Louis, Mo	Personal request	May 5	14 cattle	Tuberculosis	Quarantined.
J. W. Risner	Couch, Mo	Return visit	May 7		No new cases	
Mitchell Payton	Patterson, Mo	Return visit	May 20			
D. D. Mayfield	Thayer, Mo	Personal request	June 8	1 bay mare	Glanders	Quarantined.
J. W. Risner	Couch, Mo	Return visit	June 15	1 bay mule	Glanders	Quarantined.
J. H. Simers	Thayer, Mo	Personal investigation	June 17	2 heifers	Texas fever	Quarantined.
Atteberry and Grotjan	Keytesville, Mo	U. S. Inspector	Aug. 4	300 sheep	Foot rot	Quarantined on Edwin Grotjan farm
Numerous parties	Mendon, Mo	Letter	Aug. 5	Different lots of hogs	Cholera	
W. E. Campbell	Koshkonong, Mo	Personal request	Aug. 9	1 gray mare	Nasal tumor	
Chas. D. Felt	Mendon, Mo		Aug. 28	600 sheep	Foot rot	Quarantined on C. D. Felt farm, 8 miles S. E. of Mendon.

ANNUAL REPORT OF DR. D. F. LUCKEY, STATE VETERINARIAN, FOR THE YEAR DECEMBER 17, 1907, TO DECEMBER 17, 1908—Continued.

Owner.	Postoffice.	How called.	Date.	Kind of stock.	Disease.	How disposed of.
Forest Nidy	Faucett, Mo	Dr. E. J. Netherton.	Oct. 22	6 mules, 2 mares	Spinal meningitis	
Henry Lohrey	Hartsburg, Mo	Telephone	Nov. 2	1 mule	Glanders	Quarantined.
Frank Paige	Rush Hill, Mo	Return visit	Nov. 4	Horses	None	
Wm. T. Sanders	Ellington, Mo	Petition	Nov. 22	1 bay gelding	Glanders	Quarantined.

ANNUAL REPORT OF DR. J. H. SLATER, DEPUTY STATE VETERINARIAN FOR THE YEAR DECEMBER 17, 1907, TO DECEMBER 17, 1908.

Owner.	Postoffice.	How called.	Date.	Kind of stock.	Disease.	How disposed of.
J. T. Lewis	Dalton, Mo	Dr. Luckey	Jan. 3	650 sheep	Scabies	Quarantined.
R. C. Stanton	Richmond, Mo	In practice	Jan 6	6 horses, 6 mules	Suspected glanders	Quarantined.
R. C. Stanton	Richmond, Mo	Return visit	Jan. 9	1 mule	Acute glanders	
R. C. Stanton	Richmond, Mo	Return visit	Jan. 10	1 mule, 1 horse	Acute glanders	
R. C. Stanton	Richmond, Mo	Return visit	Jan. 11	Mules and horse	Acute glanders	Quarantined, 1 mule dead.
R. C. Stanton	Richmond, Mo		Mar. 6			Quarantine released.
Frank Harvey	Henry	In private practice	May 1	1 black stallion	Suspected glanders	Mallein test, no positive reaction.
Clarence Hubble	Richmond, Mo	In private practice	May 9	1 black mare	Suspected glanders	Mallein test, no reaction.
J. T. Lewis & Jno Darrance	Dalton, Mo	Dr. Luckey	May 31	650 sheep	Scabies	Advised redipping.
L. H. DeWalt	Mendon, Mo	Secretary Ellis	July 31	Hogs	Lung worms	
John Wohlgemuth	Bosworth, Mo	Secretary Ellis	Nov. 16	2 horses	Acute glanders	Quarantined.

ANNUAL REPORT OF DR. W. B. WELCH, DEPUTY STATE VETERINARIAN, FOR THE YEAR DECEMBER 17, 1909, TO DECEMBER 17, 1908.

Owner.	Postoffice.	How called.	Date.	Kind of stock.	Disease.	How disposed of.
W. W. Webb	Marshall, Mo	Dr. Luckey	June 8	3 head cattle	Healthy	
H. Schoperkoetter	Corder, Mo	Secretary Ellis	Sept. 17	5 cattle, 4 dead	Splenic Fever	Dead, burned.

ANNUAL REPORT OF DR. H. C. TUCK, DEPUTY STATE VETERINARIAN, FOR THE YEAR DECEMBER 17, 1907, TO DECEMBER 17, 1908.

Owner.	Postoffice.	How called.	Date.	Kind of stock.	Disease.	How disposed of.
J. W. Risner, Jr	Couch, Mo	Dr. Luckey	Apr. 3	1 horse	Glanders	Slaughtered.
A. H. Ragland	Conway, Mo	Dr. Luckey	Apr. 6	1 mare	Nasal gleet	
J. P. Burtchett	Wentworth, Mo	Secretary Ellis	May 28	1 gelding	Glanders	Quarantined.
M. A. Snider	Southwest City	Owner	Sept. 22	1 gelding	Sub-acute glanders	Quarantined.
Andrew York	Anderson, Mo	Owner	Oct. 3	1 mare	Chronic glanders	Quarantined.

ANNUAL REPORT OF DR. C. E. STEEL, DEPUTY STATE VETERINARIAN, FOR THE YEAR DECEMBER 17, 1907, TO DECEMBER 17, 1908.

Owner.	Postoffice.	How called.	Date.	Kind of stock.	Disease.	How disposed of.
Olsen, Stormer & Gaus	St. Joseph Mo	Owner	Mar. 1	Horses and mules	No disease	Quarantine lifted.
Wm. Stufflebean	Saxton, Mo	Owner	Mar. 2	3 horses	Suspected glanders	Left in quarantine.
Henry Lytton	Saxton, Mo	Owner	Mar. 2	2 horses	Glanders	Condemned.
David Pasley	Saxton, Mo	While practicing	Mar. 2	6 horses	Glanders	Quarantined.
A. J. Wake	St. Joseph, Mo	Owner	Mar. 6	2 horses	Glanders	1 condemned, other quarantined.
John Pasley	Saxton, Mo	Owner	Mar. 11	Horses	Suspected glanders	No reaction and Mallein test.
Ed Pasley	Hemple, Mo	Owner	Mar. 11	2 horses	Chronic glanders	Destroyed.
Mr. Underwood	Hemple, Mo		Mar. 24	1 horse	Simple catarrh accompanying strangles	
Sam'l Cook	Hemple, Mo	Request	Mar. 25	2 horses		Released premises from quarantine.
Wm. Stufflebean	Saxton, Mo	Return visit	Mar. 26	3 horses	Glanders	Condemned.
J. H. Riley	Agency, Mo	Owner	April 3	3 mules	Acute nasal glanders in two, chronic farcy in one	Advised destruction.
J. H. Riley	Agency, Mo	Return visit	April 4	2 mules, 1 horse	Free from glanders	
J. H. Riley	Agency, Mo	Owner	Apr. 4	1 mule	Fever from exposure	
Geo. Lane	Agency, Mo	E. N. Reynolds	Apr. 5	1 mule, 1 mare	Irregular strangles, lameness in fore limb	
E. N. Reynolds	Agency, Mo	Phone	Apr. 10	1 mare	Suspected glanders	Isolated.
E. N. Reynolds	Agency, Mo	Return visit	Apr. 11	1 mare	No glanders	
Henry Doekhorn	St. Joseph, Mo	Owner	Apr. 12	1 gelding	Glanders (acute nasal)	Quarantined.
Doekhorn-Jacobs	St. Joseph, Mo		Apr. 14	1 horse	Suspected glanders	

ANNUAL REPORT OF DR. C. E. STEEL, DEPUTY STATE VETERINARIAN, FOR THE YEAR DEC. 17, 1907, TO DEC. 17, 1908—Continued.

Owner.	Postoffice.	How called.	Date.	Kind of stock.	Disease.	How disposed of.
C. P. Williams	Gower, Mo.	Letter from W. P. Riley	Apr. 29	2 fillies	Nasal glanders	Quarantined.
Thos. Tyre	Gower, Mo.	....	May 2	2 horses	Suspected glanders	....
Wm. P. Riley	Gower, Mo.	Owner	May 3	10 head horses	Mallein test shows no glanders	
Joe DuLaney	Gower, Mo.	....	May 12	1 gray mare	Nasal glanders	....
Edward Lyons	Gower, Mo.	Owner	May 16	1 gray mare	Nasal catarrh, bad tooth	Condemned.
Sam'l Melbourne	St. Joseph, Mo	Owner	June 3	1 horse	Mange	Quarantined.
R. B. Payne	Easton, Mo	County Court	June 21	....	....	Stable disinfected.
Joseph DuLaney	Gower, Mo.	Phone	June 28	....	....	....
W. P. Riley	Gower, Mo.	Return visit	June 29	....	....	Advised of horses.
W. A. Simmons	St. Joseph, Mo	Owner	Aug. 16	1 cow	Suspected rabies	Quarantined.
W. A. Simmons	St. Joseph, Mo	City Bd. of Health	Aug. 17	1 cow	Suspected rabies	Quarantined and closely confined.
W. A. Simmons	St. Joseph, Mo	Owner	Aug. 18	1 cow	Suspected rabies	Quarantined still.
W. A. Simmons	St. Joseph, Mo	....	Aug. 20	2 horses	Rabies	Mare shot, gelding quarantined.
Middleton Payne	Platte City, Mo	Dr. Luckey	Nov. 18	1 horse	Generalized septicemia	

ANNUAL REPORT OF DR. R. C. MOORE, DEPUTY STATE VETERINARIAN, FOR THE YEAR DECEMBER 17, 1907, TO DECEMBER 17, 1908.

Owner.	Postoffice.	How called.	Date.	Kind of stock.	Disease.	How disposed of.
Roy Feagan	Kansas City, Mo	....	Dec. 17, 07	....	....	Inspected stable, found disinfected.
W. J. Long	Kansas City, Mo	....		....	....	....
W. C. Farr	Kansas City, Mo	....	Dec. 22, 07	1 bay gelding	Chronic glanders	Quarantined.
Dr. Fraham	Independence, Mo	....	Dec. 22, 07	1 bay mare	Suspected glanders	Quarantined.
S. K. Van Trump	Kansas City, Mo	....	Dec. 25, 07	1 bay mare	Chronic glanders	Destroyed without appraisement.
Roy Feagan	Kansas City, Mo	....	Dec. 23, 07	1 bay gelding	Chronic glanders	Quarantined.
John Jackson	Kansas City, Mo	....	Dec. 25, 07	1 black gelding	Chronic glanders	Quarantined.
John Casey	Independence, Mo	....	Dec. 27, 07	1 bay gelding	Chronic glanders	Quarantined.
Val Blatz Brewing Co	Kansas City, Mo	....	Dec. 28, 07	1 horse	Chronic glanders	Destroyed without appraisement.

G. T. Kinney	Kansas City, Mo.		Dec. 28, 07	1 horse	Chronic glanders	Quarantined.
Barney Malloy	Kansas City, Mo.		Dec. 29, 07	1 mule	Chronic glanders	Quarantined.
W. C. Farr	Kansas City, Mo.		Dec. 29, 07			Inspected stable, found disinfected.
John Kellarn	Kansas City, Mo.		Jan. 1	1 horse	Chronic glanders	Quarantined.
Fern Laundry Co.	Kansas City, Mo.		Jan. 1	1 horse	Suspected glanders	Mallein test, no reaction.
A. Truax	Kansas City, Mo.		Jan. 2	1 mule	Chronic glanders:	Quarantined.
J. Johnson	Kansas City, Mo.		Jan. 4			Inspected stable, found disinfected.
Barney Malby	Kansas City, Mo.		Jan. 5			Inspected stable, found disinfected.
August Shapper	Kansas City, Mo.		Jan. 6	1 horse	Chronic glanders	Quarantined.
G. T. Kinney	Kansas City, Mo.		Jan. 6			Inspected stable, found disinfected.
Joe Taratola	Kansas City, Mo.	Attending veter'nrn	Jan. 7	1 horse	Glanders	Destroyed without appraisement.
J. Kellam	Kansas City, Mo.		Jan. 8			Inspected stable, found disinfected.
August Shapper	Kansas City, Mo.		Jan. 8	1 horse	Suspected glanders	Mallein test, no reaction.
B. Ailboin	Kansas City, Mo.	Attending veter'nrn	Jan. 9	1 horse	Chronic glanders	Quarantined.
A. Truax	Kansas City, Mo.		Jan. 9			Inspected stable, found disinfected.
August Shapper	Kansas City, Mo.		Jan. 13			Inspected stable, found disinfected.
Joe Taratola	Kansas City, Mo.		Jan. 13			Inspected stable, found disinfected.
John Adams	Kansas City, Mo.	Owner	Jan. 14	1 horse	Injured neck	
T. S. Stone	Kansas City, Mo.		Jan. 17	1 horse	Chronic glanders	Quarantined.
Val Blatz Brewing Co.	Kansas City, Mo.	Attending veter'nrn	Jan. 22	1 horse	Chronic glanders	Destroyed by owner without appraisement.
Dr. Timothy Riley	Kansas City, Mo.	Owner	Jan. 23	1 horse	Chronic glanders	Quarantined.
Val. Blatz Brewing Co.	Kansas City, Mo.	Attending veter'nrn	Jan. 26	Horses	Suspected glanders	2 quarantined.
F. J. Schadel	Kansas City, Mo.	Attending veter'nrn	Feb. 2	1 horse	Chronic glanders	Quarantined.
Mrs. M. Small	Kansas City, Mo.	Owner	Feb. 3	1 horse	Chronic glanders	Quarantined.
Mrs. M. Small	Kansas City, Mo.	Owner	Feb. 4	1 horse	Chronic glanders	Quarantined.
Sam Fieldman	Kansas City, Mo.	Unknown party	Feb. 5	1 horse	Glanders	Destroyed by consent of owner without appraisement.
G. Schroer	Kansas City, Mo.		Feb. 5			Quarantined stable.
Mr. Evans	Kansas City, Mo.	Humane officer	Feb. 6	1 horse	Fistulous withers	
G. Shroer	Kansas City, Mo.		Feb. 12			Inspected stable, found disinfected.
E. Dorn	Kansas City, Mo.	Owner	Feb. 13	1 horse	Chronic glanders	Quarantined.
J. J. Thompson	Kansas City, Mo.	Owner	Feb. 15	1 horse	Suspected glanders	Mallein test, no reaction.
W. F. Ragan	Independence, Mo.	Owner	Feb. 22	1 horse	Chronic glanders.	Quarantined.
Ed. A. Watson	Kansas City, Mo.	Owner	Feb. 24	1 horse	Chronic glanders	Quarantined.
O. Shelby	Kansas City, Mo.	Owner	Feb 25	1 horse	Chronic glanders	Quarantined.
Jerry Donnelly	Kansas City, Mo.	Owner	Feb. 26	1 horse	Chronic glanders	Quarantined.
Rob Carter	Kansas City, Mo.	Humane officer	Feb. 27	1 horse		
Unknown	Kansas City, Mo.	Police	Feb. 27	1 horse	Ulcerated tooth	
J. R. Shephard	Lee's Summit, Mo.	Attending veter'nrn	Feb. 29	1 horse	Chronic glanders	Quarantined.

ANNUAL REPORT OF DR. R. C. MOORE, DEPUTY STATE VETERINARIAN, FOR THE YEAR DEC. 17, 1907, TO DEC. 17, 1908—Continued.

Owner.	Postoffice.	How called.	Date.	Kind of stock.	Disease.	How disposed of.
E. Hunter	Kansas City, Mo		Mar. 12	1 horse	Chronic glanders	Quarantined.
Thos. Sheehy	Kansas City, Mo	Owner	Mar. 30	1 horse	Chronic glanders	Quarantined.
Dr. A. Trickett	Kansas City, Mo		Apr. 11	2 horses	Ulcerated tooth	
Wood Bryant	Kansas City, Mo	Owner	Apr. 14	1 horse	Chronic glanders	Quarantined.
John Doe	Kansas City, Mo		Apr. 16	1 horse	Melanosis	
E. McLean	Warrensburg, Mo		Apr. 17	Calves	Cerebral meningitis	
W. A. Brannock	Kansas City, Mo	Owner	Apr. 18	5 horses	Chronic glanders	Quarantined.
Transfer Co	Kansas City, Mo	Employee	Apr. 18		Reported glanders	No disease.
W. A. Brannock	Kansas City, Mo		Apr. 19			Stable inspected, nothing found.
John Lutz	Kansas City, Mo	Attending veter'nrn	Apr. 28	1 horse	Nasal catarrh	
Dierks Lumber Co	Kansas City, Mo	Owner	Apr. 29	1 horse	Chronic glanders	Quarantined.
J. S. Schwarz	Kansas City, Mo		Apr. 30	1 horse	Chronic glanders	Quarantined.
J. T. Ziegler	Kansas City, Mo	Attending veter'nrn	May 3	1 horse	Chronic glanders	Quarantined.
C. F. Bowman	Kansas City, Mo	Owner	May 10	1 horse	Chronic glanders	Quarantined.
Sam Weinburg	Kansas City, Mo	Attending veter'nrn	May 12	1 horse	Suspected glanders	Held for investigation.
Joseph Weinburg	Kansas City, Mo	Attending veter'nrn	May 13	horse	Chronic glanders	Destroyed without appraisement at request of owner.
C. F. Bowman	Kansas City, Mo	Owner	May 14	1 horse		No disease.
Williams	Kansas City, Mo		May 16	1 horse	Suspected glanders	
M. Fry	Kansas City, Mo	Owner	May 17	1 horse	Melano-sarcoma	Reported to Humane Society.
J. Schwarz	Kansas City, Mo		May 18			Inspected stable, found disinfected.
Dr. W. H. Gatchell	Kansas City, Mo	Owner	May 25	1 mule	Chronic glanders	Quarantined.
A. O. Rose	Kansas City, Mo	Owner	May 26	1 horse	Chronic glanders	Quarantined.
J. T. Zeigler	Kansas City, Mo		May 26			Inspected stable, found disinfected.
Wm. Coats	Kansas City, Mo		May 29	1 horse	Chronic glanders	Quarantined.
A. O. Rose	Kansas City, Mo		May 30	1 horse	Suspected glanders	No reaction.
Joe Daniels	Kansas City, Mo		June 4	1 horse	Suspected glanders	Quarantined.
H. S. Halbert	Kansas City, Mo	Dr. Carter	June 5	1 horse	Eczema	
D. O. Gaines	Kansas City, Mo		June 9	1 horse	Chronic glanders	Quarantined.
Henry Shapira	Kansas City, Mo	Found on street	June 10	1 horse	Chronic glanders	Quarantined.
Chamberlain & Meyers	Kansas City, Mo	Attending Veter'nrn	June 11	2 horses	Chronic glanders	Quarantined.
John Willington	Kansas City, Mo	Mr. Kirby	June 12	1 horse	Cerebritis	
R. B. Franklin	Kansas City, Mo	Attending veter'nrn	June 12	2 horses	Chronic glanders	Quarantined.
R. B. Franklin	Kansas City, Mo		June 13	1 horse	Glanders	Quarantined.

Joe Daniels	Kansas City, Mo	Return call	June 16	1 horse	Nothing found	
Frank Livingston	Kansas City, Mo	Mr. Kinney	June 17	1 horse	Catarrahal tracheitis	
Wm. DeLapp	Kansas City, Mo		June 19	1 horse	Chronic glanders	Quarantined.
R. B. Franklin	Kansas City, Mo		June 24			Inspected stables, found disinfected.
John Daley	Kansas City, Mo		June 24	1 horse	Suspected glanders	Quarantined.
John Daly	Kansas City, Mo	Return visit	July 1	1 horse	Chronic glanders	Reported to county court.
Baker & Wells	Kansas City, Mo	Found on street	July 3	1 horse	Chronic glanders	Reported to county court.
Wolf Bros. Laundry Co	Kansas City, Mo	Owner	July 5	2 horses	Chronic glanders	Quarantined.
E. S. Bonton	Kansas City, Mo		July 6	1 mule	Chronic glanders	
Mr. McKay	Kansas City, Mo	Owner	July 12	1 horse	Suspected glanders	Dead on arrival.
Dr. W. H. Gatchell	Kansas City, Mo	Owner	July 12	1 horse	Chronic glanders	Quarantined.
Dr. Bradley	Urich, Mo		July 16	Several horses	Rendering assistance to Dr. Bradley	
Morris Coal Co	Kansas City, Mo		July 20	1 horse	Suspected glanders	Mallein test, no reaction.
Thomas Sheehy	Kansas City, Mo		July 21	1 horse	Chronic glanders	Quarantined.
B. H. Brink	Kansas City, Mo	Owner	July 24	1 horse	Chronic glanders	Quarantined.
E. S. Bonton	Kansas City, Mo		July 24			Inspected stable, found disinfected.
Abe Tabusky	Kansas City, Mo		July 25	1 horse	Chronic glanders	Quarantined.
M. Wedge	Kansas City, Mo	Owner	July 28	1 horse	Bronchial pneumonia	
Unknown	Kansas City, Mo	Police	July 31	1 horse	Lymphangitis	
Jones Transfer Co	Kansas City, Mo	Mr. Hurlburt	Aug. 8	1 horse	Ulcerated tooth	
James Ross	Kansas City, Mo	Attending veter'nrn	Aug. 10	1 horse	Chronic glanders	Quarantined.
Dr. W. H. Gatchell	Kansas City, Mo	Owner	Aug. 11	1 mule	Chronic glanders	Quarantined.
J. J. Mullen	Kansas City, Mo	Owner	Aug. 14	1 horse	Chronic glanders	Quarantined.
O. J. Sutter	Kansas City, Mo	Dr. Trickett	Aug. 22	1 horse	Chronic glanders	Quarantined.
Rosenberg and Godson	Kansas City, Mo	Owner	Aug. 24	1 horse	Chronic glanders	Quarantined.
Wolf Bros. Laundry	Kansas City, Mo		Aug. 28	1 horse	Chronic glanders	Destroyed by consent of owner without appraisement.
Kloos & Son	Independence, Mo	M. A. Peck	Sept. 1	1 brown gelding	Chronic glanders	Destroyed by consent of owner without appraisement.
Henry Schuman	Kansas City, Mo	Owner	Sept. 2	1 dun gelding	Chronic glanders	Quarantined.
Flannagan Bros	Kansas City, Mo	Owner	Sept. 2	1 brown gelding	Suspected glanders	Held for investigation.
Horace Ellsworth	Kansas City, Mo	Owner	Sept. 5	1 horse	Chronic glanders	Quarantined.
Wm. Moore	Independence, Mo	Mr. Baker	Sept. 6	1 horse	Nasal catarrh	
Philip Holdman	Kansas City, Mo		Sept. 7	1 horse	Chronic glanders	Quarantined.
Flanagan Bros	Kansas City, Mo	Attending veter'nrn	Sept. 19	1 horse	Chronic glanders	Quarantined.
J. J. Cray	Independence, Mo	Attending veter'nrn	Sept. 20	1 horse	Purpura	
C. A. Brackett	Kansas City, Mo	Owner	Sept. 21	1 horse	Suspected glanders	Mallein test, no reaction.
Dr. W. H. Gatchell	Kansas City, Mo	Owner	Sept. 25	1 mule	Chronic glanders	Quarantined.

ANNUAL REPORT OF DR. R. C. MOORE, DEPUTY STATE VETERINARIAN, FOR THE YEAR DEC. 17, 1907, TO DEC. 17, 1908—Continued.

Owner.	Postoffice.	How called.	Date.	Kind of stock.	Disease.	How disposed of.
E. W. Shields	Kansas City, Mo	Owner	Sept. 30	1 horse	Glanders	Destroyed by consent of owner without appraisement.
Wm. Campbell	Hickman Mills, Mo	Owner	Oct. 3	Several horses	Exposed to glanders	Quarantined.
M. Genova	Kansas City, Mo		Oct. 5	1 gray gelding	Suspected glanders	Destroyed by consent of owner without appraisement.
B. H. Brooks	Kansas City, Mo		Oct. 6	1 roan mare	Chronic glanders	Destroyed by consent of owner without appraisement.
Wolf Bros. Laundry	Kansas City, Mo		Oct. 7	1 bay mare	Suspected glanders	No reaction.
Lafferty Grocery	Kansas City, Mo		Oct. 7	1 horse	Chronic glanders	
K. C. Elevator Co	Kansas City, Mo		Oct. 9	1 horse	Suspected glanders	
J. M. Mulkey	Kansas City, Mo		Oct. 14	1 gray mule	Glanders	Quarantined.
A. Truax	Kansas City, Mo		Oct. 17	1 horse	Glanders	Quarantined.
Fred Turner	Kansas City, Mo	Owner	Oct. 20	1 horse	Glanders	Quarantined.
W. D. Clark	Kansas City, Mo	Owner	Oct. 25	1 horse	Chronic glanders	Quarantined.
Peter T. McKernan	Kansas City, Mo	J. L. Zeiler	Oct. 25	1 horse	Chronic glanders	Quarantined.
Clark Bros	Hickman Mills, Mo	Owner	Oct. 26	Several horses	Exposed to glanders	
James Flanagan	Kansas City, Mo		Oct. 28	1 mule, 1 horse	Chronic glanders	Quarantined.
J. B. Forbes	Kansas City, Mo	Dr. Peck	Oct. 31	1 horse	Glanders	Destroyed by consent of owner.
J. G. Ritter	Kansas City, Mo	Attending veter'nrn	Nov. 11	1 horse	Chronic glanders	Quarantined.
L. E. Murphy	Kansas City, Mo		Nov. 5	1 horse	Suspected glanders	Quarantined.
A. Truax	Kansas City, Mo		Nov. 6			Inspected stable, found disinfected.
J. G. Ritter	Kansas City, Mo	Dr. Gatchell	Nov. 6	1 bay gelding	Chronic glanders	Quarantined.
John Adams	Kansas City, Mo	Dr. Gatchell	Nov. 9	1 bay gelding	Suspected glanders	Quarantined.
H. Ellsworth	Kansas City, Mo	Dr. Crosby	Nov. 9	1 gray gelding	Chronic glanders	Quarantined.
Wm. F. Pyles	Kansas City, Mo		Nov. 13	1 horse	Suspected glanders	Quarantined.
Bucher & Sautter	Kansas City, Mo		Nov. 14	1 horse	Suspected glanders	Mallein test, no reaction.
J. S. Bowen	Kansas City, Mo	Humane office	Nov. 21	1 horse	Skin abrasion from injuries	
H. Ellsworth	Kansas City, Mo		Nov. 24			Inspected stable, found disinfected.
J. S. Atchison	Kansas City, Mo	Humane office	Dec. 12	1 mule	Chronic glanders	Quarantined.

ANNUAL REPORT OF DR. T. E. WHITE, DEPUTY STATE VETERINARIAN, FOR THE YEAR DECEMBER 17, 1907, TO DECEMBER 17, 1908.

Owner.	Postoffice.	How called.	Date.	Kind of stock.	Disease.	How disposed of.
J. H. Deal	Mt. Leonard, Mo	Secretary Ellis	Feb. 25	68 head steers	4 dead, Enteritis of small intestine	
Elijah Hotsenpiller	Smithton, Mo	Secretary Ellis	Aug. 6	20 sheep	Lung worms	
L. H. Vance	Fristo, Mo	Secretary Ellis	Oct. 25	5 steers	Nodular intestinal disease	Isolated.

ANNUAL REPORT OF DR. R. P. POAGE, DEPUTY STATE VETERINARIAN, FOR THE YEAR DECEMBER 17, 1907, TO DECEMBER 17, 1908.

Owner.	Postoffice.	How called.	Date.	Kind of stock.	Disease.	How disposed of.
W. H. Collins	Shelbina, Mo	Dr. Luckey	Feb. 22	40 sheep	Scabies	Quarantined.
Geo. Moss	Shelbyville, Mo	Dr. Luckey	Feb. 24	67 head sheep	Scabies	Quarantined and dip.
Albert Copenhaver	Shelbyville, Mo	Dr. Luckey	Feb. 25	50 head sheep	Scabies	Quarantined and dip.
Wm. Green	Shelbyville, Mo	Dr. Luckey	Feb. 27	8 sheep	Scabies	Quarantined and dip.
Perl Bell	Shelbyville, Mo	Dr. Luckey	Feb. 28	15 sheep	Scabies	Quarantined and dip.
J. D. Miller	Shelbina, Mo	Dr. Luckey	Aug. 31	41 sheep	Scabies	Quarantined.
Ferd. Myers	Leonard, Mo	Owner	Nov. 23	270 sheep	Scabies	Quarantined.
Scott Vanosdol	Shelbyville, Mo		Nov. 28	45 sheep	Scabies	Quarantined.
Wm. Miller	Bethel, Mo		Nov. 3	Sheep		Had been sold.

ANNUAL REPORT OF DR. S. SHELDON, DEPUTY STATE VETERINARIAN, FOR THE YEAR DECEMBER 17, 1907, TO DECEMBER 17, 1908.

Owner.	Postoffice.	How called.	Date.	Kind of stock.	Disease.	How disposed of.
G. W. Triplett	Harris, Mo	Secretary Ellis	Aug. 9	14 cattle	Texas fever	Quarantined.
Sam. Johnston	Harris, Mo	Secretary Ellis	Aug. 9	25 cattle	Texas fever	Quarantined.
G. F. Johnston	Harris, Mo	Secretary Ellis	Aug. 9	66 cattle	Texas fever	Quarantined.
Dr. C. F. Schirer	Harris, Mo	Secretary Ellis	Aug. 9	2 cows	Texas fever	Quarantined.
Thos. Hopper	Harris, Mo	Secretary Ellis	Aug. 9	2 cows	Texas fever	Quarantined.
Senator Fields	Browning Mo	Dr. Luckey	Sept. 6	1 horse		Animal died before call.
Joseph Higgins	Modena, Mo	Telephone	Oct. 4	16 cattle	Forage poison	

ANNUAL REPORT OF DR. STANLEY SMITH, DEPUTY STATE VETERINARIAN, FOR THE YEAR DECEMBER 17, 1907, TO DECEMBER 17, 1908.

Owner.	Postoffice.	How called.	Date.	Kind of stock.	Disease.	How disposed of.
C. A. R. Robinson	Kirksville, Mo.	Dr. Luckey	Mar. 29	1 cow	Tuberculosis	Quarantined.
Frank Paige	Rush Hill, Mo.	Secretary Ellis	Oct. 4	1 horse	Glanders	Ordered killed by sheriff.
J. H. Lohrey	Hartsburg, Mo	Return visit	Dec. 11	2 mules	Glanders	Quarantined.

ANNUAL REPORT OF DR. R. B. LOVE, DEPUTY STATE VETERINARIAN, FOR THE YEAR DECEMBER 17, 1907, TO DECEMBER 17, 1908.

Owner.	Postoffice.	How called.	Date.	Kind of stock.	Disease.	How disposed of.
Thos. Shields	Phillipsburg, Mo.	Dr. Luckey	Jan 4	1 mule	Pleural pneumonia	
Collins & Wasson	Ozark and Nixa, Mo.		Jan. 6	605 sheep	Scabies	Quarantined.

ANNUAL REPORT OF DR. R. J. MITCHELL, DEPUTY STATE VETERINARIAN, FOR THE YEAR DECEMBER 17, 1907, TO DECEMBER 17, 1908.

Owner.	Postoffice.	How called.	Date.	Kind of stock.	Disease.	How disposed of.
A. N. Davis	Glenwood, Mo.	Secretary Ellis	June 26	300 sheep	Scabies	Ordered dipped.
A. C. Lucas	Glenwood, Mo.	Secretary Ellis	June 26	400 sheep	Scabies	Ordered dipped.
K. & W. Railroad Co.	Downing, Mo.	Secretary Ellis	July 11	Infected pens	Scabies	Ordered disinfected.
W. N. Fidwell	Queen City, Mo.	Secretary Ellis	Oct. 9	1 cow	Tuberculosis	Killed and burned.

ANNUAL REPORT OF DR. F. W. O'BRIEN, DEPUTY STATE VETERINARIAN, FOR THE YEAR DECEMBER 17, 1907, TO DECEMBER 17, 1908.

Owner.	Postoffice.	How called.	Date.	Kind of stock.	Disease.	How disposed of.
G. S. Kellar	Palmyra, Mo	Dr. Luckey	Mar. 27	Sheep	Scabies	Quarantined.

ANNUAL REPORT OF DR. J. H. McELROY, DEPUTY STATE VETERINARIAN, FOR THE YEAR DECEMBER 17, 1907, TO DECEMBER 17, 1908.

Owner.	Postoffice.	How called.	Date.	Kind of stock.	Disease.	How disposed of.
W. E. Winan and W. O. Kennedy	Grant City, Mo	Owners	July 31	2 bay ponies, 2 bay mares, 1 sorrel mare and colt, 1 horse mule	Mange	Quarantined.

ANNUAL REPORT OF DR. H. V. GOODE, DEPUTY STATE VETERINARIAN, FOR THE YEAR DECEMBER 17, 1907, TO DECEMBER 17, 1908.

Owner.	Postoffice.	How called.	Date.	Kind of stock.	Disease.	How disposed of.
L. F. Bonnett	Halls, Mo	Cases brought to office	Dec. 20, 07	4 horses	Nasal gleet	Quarantined.
Arnson-Starmer & Gaun	St. Joseph, Mo	Discovered on examination	Jan. 25	17 horses& mules.	Glanders	6 condemned, remainder quarant'nd
W. O. Lewis	St. Joseph, Mo	H. V. Goode	Jan 26	1 horse, 1 mule	Glanders	Horse condemned, mule quarant'nd.
Wm. Stufflebean	Easton, Mo	H. V. Goode	Jan. 29	7 horses	Glanders	5 quarantined, 2 condemned.
Evans Bros	Maryville, Mo	Dr. Luckey	Feb. 28	Cattle	Scabies	Shipped to St. Joseph, Mo.
Horace Jones	Parnell, Mo	Secretary Ellis	Oct. 15	60 yearling steers.	Shipping fever	Isolated.
A. D. Yook	Skidmore	Secretary Ellis	Nov. 18	1 horse	Nasal gleet	

ANNUAL REPORT OF DR. A. J. HAMMERSTEIN, DEPUTY STATE VETERINARIAN, FOR THE YEAR DECEMBER 17, 1907, TO DECEMBER 17, 1908.

Owner.	Postoffice.	How called.	Date.	Kind of stock.	Disease.	How disposed of.
Wurst Coal & Hauling Co.	St. Louis, Mo	Letter	April 6	1 grey gelding	Glanders	Quarantined.
Herman Quinken	St. Louis, Mo	Letter	April 6	1 bay gelding	Glanders	Quarantined.
Hanses Coal, Livery & Undertaking Co	St. Louis, Mo	Dr. D. F. Luckey	May 26	2 geldings	Glanders	Destroyed.
Board of Health	City Marshal, St. Louis		June 8	1 horse		Placed in hands of police & marshal.

ANNUAL REPORT OF DR. A. J. HAMMERSTEIN, DEPUTY STATE VETERINARIAN, FOR THE YEAR DEC. 17, 1907, TO DEC. 17, 1908—Con.

Owner.	Postoffice.	How called.	Date.	Kind of stock	Disease.	How disposed of.
Board of Health and City Marshal	St. Louis	Police	June 9	1 bay gelding	Hypertrophy of nasal septum with neoplastic growth	To Humane Society.
Max Frenzel	St. Louis, Mo	Attending veter'nrn	June 16	1 grey gelding	Chronic glanders and Farcy	Quarantined.
Wurst Coal & Hauling Co.	St. Louis, Mo	Attending veter'nrn	June 19	1 grey gelding	Chronic farcy	Quarantined.
Wurst Coal & Hauling Co.	St. Louis, Mo	Attending veter'nrn	June 22	3 horses	Chronic glanders	Quarantined.
Uffmann Coal & Team'g Co	St. Louis, Mo	Attending veter'nrn	July 7	2 horses	Chronic farcy and glanders	Isolated.
W. T. Warner	St. Louis, Mo	Dr. Sollberger	July 8	1 horse	Chronic glanders	Isolated.
Wurst Coal & Hauling Co.	St. Louis, Mo	Attending veter'nrn	July 9	1 horse	Chronic farcy	Isolated.
Herman Kaiser	St. Louis, Mo	Clerk of Court of Criminal Correct'n	July 15	1 horse	Glanders and farcy	Isolated.
Philip Johler	St. Louis, Mo	Attending veter'nrn	July 15	1 horse	Chronic farcy	Isolated.
August Langguth	St. Louis, Mo	Secretary Ellis	July 17	1 horse	Chronic farcy	Isolated.
Adolph Tischer	St. Louis, Mo	Attending veter'nrn	July 29	1 horse	Chronic glanders	Isolated.
Hansas Coal, Livery & Undertaking Co	St. Louis, Mo	Attending veter'nrn	July 19	1 horse	Glanders and farcy	Isolated.
August Feldmann	St. Louis, Mo	Attending veter'nrn	Aug. 7	1 bay gelding	Chronic farcy	Isolated.
American Coke Foundry Co	St. Louis, Mo	Attending veter'nrn	Aug. 11	1 brown mule	Glanders	Quarantined.
Fred Knelange	St. Louis, Mo	Attending veter'nrn	Aug. 13	1 gray gelding	Glanders	Isolated.
American Coke Foundry Co.	St. Louis, Mo	Attending veter'nrn	Aug. 15	1 bay mule	Glanders	Quarantined.
Herring & Stegmann	St. Louis, Mo	Attending veter'nrn	Aug. 17	1 roan gelding	Glanders	Isolated.
Wm. A. Miller	St. Louis, Mo	Request of owner	Aug. 19	1 jersey cow		No disease.
Henry Waldemeyer	St. Louis, Mo	Attending veter'nrn	Aug. 20	1 black gelding	Glanders	Quarantined.
St. Louis Shaving & Sawdust Co	St. Louis, Mo	Attending veter'nrn	Aug. 21	1 bay gelding	Glanders	Quarantined.
Louis Obert Brewing Co.	St. Louis, Mo	Attending veter'nrn	Aug. 26	1 brown mare	Glanders	Isolated.
Ida Hafertepe	St. Louis, Mo	Attending veter'nrn	Aug. 29	1 gray gelding	Glanders	Isolated.
Mo. Car & Foundry Co.	St. Louis, Mo	Attending veter'nrn	Sept. 14	1 mule	Glanders and farcy	Isolated.
August This	St. Loius, Mo	Attending veter'nrn	Sept. 21	1 gray gelding	Glanders and farcy	Isolated.
Freund Bros. Bread Co.	St. Louis, Mo	Requested	Oct. 3	1 bay gelding	Chronic glanders and farcy	Isolated.
Ida Hafertepe	St. Louis, Mo	Return visit	Oct. 5	1 gray gelding	Farcy and glanders	Isolated.

Edward Meyer	St. Louis, Mo	Requested	Oct. 15	1 gray gelding	Nasal gleet	
Phoenon Brewery	St. Louis, Mo	Requested	Oct. 23	1 bay gelding	Suspected glanders	
Wm. R. Schroeder	Fernridge, Mo	Requested	Oct. 24	1 black gelding	Malignant growth of sinus	Advised destruction.
Henry Waldermeyer	St. Louis, Mo	Requested	Oct. 25	1 bay gelding	Chronic farcy and glanders	Isolated.
Atanas Shapkas	St. Louis, Mo	Attending veter'nrn	Oct. 28	1 bay mare	Nasal stenosis due to fracture of long st'dg	Humane Society.
Henry Waldermeyer	St. Louis, Mo	Attending veter'nrn	Nov. 9	1 brown gelding	Chronic farcy	Isolated.
Henry Waldermeyer	St. Louis, Mo	Requested	Nov. 9	1 bay gelding	Glanders and farcy	Isolated.
Henry Waldermeyer	St. Louis, Mo	Requested	Nov. 13	2 horses	Glanders and farcy	Isolated.
Henry Waldermeyer	St. Louis, Mo	Requested	Nov. 13	2 geldings	Glanders and farcy	Isolated.
Henry Waldermeyer	St. Louis, Mo	Requested	Nov. 15	All his horses		
Daniel Greiser	St. Louis, Mo	Requested	Nov. 17	1 horse	Chronic glanders	Isolated.

ANNUAL REPORT OF DR. E. M. HENDY, DEPUTY STATE VETERINARIAN, FOR THE YEAR DECEMBER 17, 1907, TO DECEMBER 17, 1908.

Owner.	Postoffice.	How called.	Date.	Kind of stock.	Disease.	How disposed of.
H. A. Kreckemeyr & others	Union, Mo	Secretary Ellis	Dec. 19, 07	6 horses & mules	Irregular strangles	
Jas. Dieckneite	Hoecker, Mo	Letter	Mar. 10	1 mare	Ulcerated molar	
Mr. Dalton	Catawissa, Mo	Telephone	May 20	2 horses	Died with distemper	
E. C. Smith	Jefferson City, Mo	Telephone	July 1	2 mules	Strangles.	
E. C. Smith	Jefferson City, Mo	Telephone	Aug. 10	1 mule	Glanders	Condemned.
Henry Schroeder	Meta, Mo	Dr. Luckey	Aug. 21	1 mule	Ericephalitis	
Fritz Grirchen	Welcome, Mo	Letter	Aug. 23	1 horse	Irregular strangles	Treated.

ANNUAL REPORT OF DR. JAS. CULLISON, DEPUTY STATE VETERINARIAN, FOR THE YEAR DECEMBER 17, 1907, TO DECEMBER 17, 1908.

Owner.	Postoffice.	How called.	Date.	Kind of stock.	Disease.	How disposed of.
A. J. Matthews	Sikeston, Mo	Letter	Mar. 11	1 mule	Chronic farcy	Turned over to county court.
C. F. Weston	East Prairie, Mo	Letter	Mar. 19	2 mules	Chronic glanders	
Shelby and Stewart	Charleston, Mo		Apr. 25	1 mule	Acute glanders	Ordered county court to kill & burn.

ANNUAL REPORT OF DR. JAS. CULLISON, DEPUTY STATE VETERINARIAN, FOR THE YEAR DEC. 17, 1907, TO DEC. 17, 1908—Continued.

Owner.	Postoffice.	How called.	Date.	Kind of stock.	Disease.	How disposed of.
H. J. Kindred	Blodgett, Mo	Letter	May 10			
B. F. Wilkinson	East Prairie, Mo	Telegram	May 12	1 horse	Chronic glanders	Ordered sheriff to kill and bury.
J. N. Johnson	Sikeston, Mo		May 18	1 horse	Chronic glanders	Turned over to county court to kill.
Lee Vaughn	East Prairie, Mo	Lee Vaughn	June 17	1 mule	Chronic glanders	Ordered county court to kill & bury
C. F. Weston	East Prairie, Mo		June 24	1 mare	Chronic glanders	Turned over to county court.
B. M. Willburn	East Prairie, Mo	Return visit	Aug. 6	1 horse	Chronic glanders	Ordered court to kill same and burn.
Alia Lee	Medley, Mo	Letter	Dec. 1	1 mule	Suspected glanders	

ANNUAL REPORT OF DR. L. G. CLARK, DEPUTY STATE VETERINARIAN, FOR THE YEAR DECEMBER 17, 1907 TO DECEMBER 17, 1908.

Owner.	Postoffice.	How called.	Date.	Kind of stock.	Disease.	How disposed of.
Lipscombs Bros	Liberal, Mo	Dr. Luckey	Feb. 5	80 cattle	Scabies	Quarantined.
James Lhysdale	Butler, Mo	Dr. Luckey	May 29	140 head sheep	Scabies	Quarantined.
Gus Herman	Butler, Mo	Dr. Luckey	May 29	25 sheep	Scabies	Quarantined.
H. A. Clark	Butler, Mo	Dr. Luckey	May 29	70 sheep	Scabies	Quarantined.
A. A. Taylor	Richards, Mo	Secretary Ellis	July 19	28 head cattle	Texas fever	Quarantined, 9 died.
Price and Parmer	Richards, Mo	Secretary Ellis	July 19	65 head cattle	Texas fever	Quarantined.
J. W. Wilson	Rich Hill, Mo	Secretary Ellis	Sept. 15	6 horses (5 died)	Influenza with complications of intestines and symptoms of purpura hemorrhagiea	Disinfected stables.
Charlie Troxell	Nevada, Mo	Secretary Ellis	Sept. 22	1 gray mare	Catarrh of maxillary sinus due to an ulcerated tooth	
M. H. Price	Butler, Mo	Owner	Oct. 12	110 sheep	Scabies	Dipped.
A. A. Taylor	Richards, Mo		Nov. 9	18 head cattle	Texas fever	Quarantined.
Price & Parmer	Richards, Mo		Nov. 9	70 head cattle	Texas fever	Quarantined.

ANNUAL REPORT OF DR. A. C. DONOHEW, DEPUTY STATE VETERINARIAN, FOR THE YEAR DECEMBER 17, 1907, TO DECEMBER 17, 1908.

Owner.	Postoffice.	How called.	Date.	Kind of stock.	Disease.	How disposed of.
Henry Lowe	Speed, Mo	Found in practice	May 5	1 mare	Glanders	Destroyed.
C. W. Atkinson	Speed, Mo	Dr. Luckey	Aug. 17	25 sheep	Stomach worms	Prescribed treatment.
Wm. Teason	Boonville, Mo	Telephone	Nov. 26	1 horse	Glanders	Prescribed treatment.

ANNUAL REPORT OF DR. HORACE BRADLEY, DEPUTY STATE VETERINARIAN, FOR THE YEAR DECEMBER 17, 1907, TO DECEMBER 17, 1908.

Owner.	Postoffice.	How called.	Date.	Kind of stock.	Disease.	How disposed of.
John Angle	Clinton, Mo	Return visit	Mar. 5	2 horses	Reacted to Mallein test	Quarantined.
George Nelson	Garden City, Mo	Dr. Luckey	Mar. 11	147 cattle	Free from disease	
Chas. Henderson	Garden City, Mo	J. E. Schertz	Mar. 11	34 sheep	Free from disease.	
J. E. Schertz	Garden City, Mo	Dr. Luckey	Mar. 11	600 sheep	Scabies	Dipped.
T. W. Pontz	Peculiar, Mo	Dr. Luckey	Mar. 12	152 sheep	Scabies	Dipped.
W. I. Yates	Creighton, Mo	Secretary Ellis	May 29	1 horse	Aenemia following shipping fever	
Chas. Robinson	Blackmer, Mo	Secretary Ellis	June 25	1 horse	Complications following distemper	
Mrs. Judge Marks	Clinton, Mo	Secretary Ellis	June 29	1 horse	Ergotism	
John Hibbs	Urich, Mo	Secretary Ellis	July 8	3 horses	Malaria	
J. S. Hibbs	Urich, Mo	Return visit	July 16	2 horses	Undetermined	
John Guiser	Stockton, Mo	Secretary Ellis	Aug. 27	20 head cattle	Epizootic aphtha	2 dead.
John Drach	Clinton, Mo	Secretary Ellis	Aug. 27	28 hogs	Hog cholera	Want serum inoculation.
S. N. Mayes	Clinton, Mo	In connection with Jno. Drach's case	Aug. 27	16 hogs	Hog cholera	
C. C. Chilton	Pleasant Hill, Mo	Dr. Luckey	Sept. 25	1 mule		Dead.
J. S. Hibbs	Urich, Mo	Dr. Luckey	Sept. 24	1 gray horse, sorrel mare	Malaria swamp fever or perniceous amenia	Dead.
Mr. Logan (colored)	Pleasant Hill, Mo	Dr. Luckey	Sept. 25	1 black horse		

ANNUAL REPORT OF DR. E. BRAINERD, DEPUTY STATE VETERINARIAN, FOR THE YEAR DECEMBER 17, 1907, TO DECEMBER 17, 1908.

Owner.	Postoffice.	How called.	Date.	Kind of stock.	Disease.	How disposed of.
Estell Thomas	Lancaster, Mo	Dr. Luckey	Apr. 10	11 sheep	Scabies	Quarantined.
Chester Vandike	Lancaster, Mo	Dr. Luckey	Apr. 10	9 sheep	Scabies	Quarantined.

ANNUAL REPORT OF DR. H. F. BOETTNER, DEPUTY STATE VETERINARIAN, FOR THE YEAR DECEMBER 17, 1907, TO DECEMBER 17, 1908.

Owner.	Postoffice.	How called.	Date.	Kind of stock.	Disease.	How disposed of.
Lemuel Louis	Big Barren Creek, Mo	Telegram	Feb. 11	1 horse	Necrosis of teeth	Non-contagious.
Rosco C. Cook	Fredericktown, Mo	By petition	Aug. 3	1 horse	Chronic glanders	Burned.

ANNUAL REPORT OF DR. W. F. BERRY, DEPUTY STATE VETERINARIAN, FOR THE YEAR DECEMBER 17, 1907, TO DECEMBER 17, 1908.

Owner.	Postoffice.	How called.	Date.	Kind of stock.	Disease.	How disposed of.
C. H. Westfall	Porto Rico, Mo	Dr. W. F. Berry	Feb. 9	1 horse	Chronic glanders	Quarantined.
L. D. Hill	Joplin, Mo	Owner	June 19	1 horse	Acute glanders	Quarantined.

ANNUAL REPORT OF DR. L. D. BROWN, DEPUTY STATE VETERINARIAN, FOR THE YEAR DECEMBER 17, 1907, TO DECEMBER 17, 1908.

Owner.	Postoffice.	How called.	Date.	Kind of stock.	Disease.	How disposed of.
Wm. Blakston	Hamilton, Mo	Dr. D. F. Luckey	Dec. 19,07	22 head cattle	Tuberculosis	No infection in the herd.
Rankin & McIntosh	Fairfax, Mo	Dr. D. F. Luckey	Dec. 21, 07	216 sheep	Scabies	Quarantined.
Edgar Beck	Fairfax, Mo	Dr. D. F. Luckey	Jan. 7, '08	1,367 sheep	Scabies infection	Quarantined.
J. S. Sillers	Fairfax, Mo	Dr. D. F. Luckey	Jan. 7	946 sheep	Slight infection of scabies	Quarantined 500 head.
E. H. Woodhouse	Fairfax, Mo	Dr. D. F. Luckey	Jan 8	Cattle	Reported scabies infection	

C. M. Peden	Fairfax, Mo		Jan. 8	Sheep	Scab in an advanced stage	Quarantined, with instructions to shear and dip.
Lyman B. Bathgait	Polo, Mo	Dr. D. F. Luckey	Jan. 17	Sheep	Scabies	Quarantined.
P. A. Sillers	Fairfax, Mo	Return call	Jan. 14	480 sheep	Scabies infection	Quarantined.
P. E. Burdick	Polo, Mo	Dr. D. F. Luckey	Jan. 17	30 sheep	Scabies infection	Quarantined.
Fred Yokum	Cowgill, Mo	Dr. D. F. Luckey	Jan. 17	30 sheep	Scabies	Quarantined.
Chas. Sackman	Cowgill, Mo	Dr. D. F. Luckey	Jan. 18	154 sheep	Scabies infection	Quarantined.
Irvin Craig	Cowgill, Mo	In connection with other cases	Jan. 18	3 sheep	Scab	Quarantined.
J. T. McPheeters	Cowgill, Mo	Observed while passing farm	Jan. 18	46 sheep	Scabies	Quarantined.
Linville & Swaithe	Cowgill, Mo	Dr. D. F. Luckey	Jan. 18	400 lambs 750, sheep	Scabies infection	Quarantined.
Oscar McNew	Cowgill, Mo	Dr. D. F. Luckey	Jan. 18	110 sheep	Scabies	Quarantined.
Thos. S. Harris	Cowgill, Mo	Dr. D. F. Luckey	Jan. 18	87 sheep	Scabies	Quarantined.
Sam. Thompson	Cowgill, Mo	In connection with other cases	Jan. 21	97 sheep	Scabies	Quarantined.
Jake Switze & Son	Cowgill, Mo	In connection with other cases	Jan. 21	230 sheep	Scabies	Quarantined.
E. McNew	Cowgill, Mo	Visited on history	Jan. 21	77 sheep	Scabies	Quarantined.
G. A. Switzer	Cowgill, Mo	In connection with the outbreak at Cowgill	Jan. 22	180 sheep	Scabies	Quarantined.
J. E. Smith	Polo, Mo	Visited on history	Jan. 22	44 sheep	Scabies	Quarantined.
M. H. Hall	Tarkio, Mo	Dr. D. F. Luckey	Feb. 11	Cattle	Report of Scabies	
J. K. Campbell & Bailey	Langdon, Mo	Dr. D. F. Luckey	Feb. 13	Cattle	Scabies infection	Quarantined.
W. W. VanSant	Lake Contrary, Mo	Visited on history	Feb. 25	Sheep	Scabies infection	Quarantined.
Wm. Hopkins	Breckenridge, Mo	Return call	Mar. 16	Sheep	Scabies	Quarantined.
John Peirce	Braymer, Mo	Visited on history	Mar. 23	108 sheep	Scabies infection	Quarantined.
Geo. Walters	Mooresville, Mo	Visited on history	April 3	2 sheep	Scabies	Quarantined.
Paul Bird	Chillicothe, Mo	Further investigation	Apr. 10	Sheep	No disease	
Thos. H. Cooper	Langdon, Mo	Dr. D. F. Luckey	Apr. 16	21 cattle	Scabies infection	Quarantined.
Linville & Swaithe	Cowgill & Kingston, Mo.	Return visit	Apr. 20	503 head sheep	Scabies infection	Quarantined.
Campbell & Bailey, Thos. Cooper & Jno. Cooper	Langdon, Mo	Return visit	Apr. 24	203 cattle	Scabies	Campbell's and Bailey's released Jno. Cooper's cattle held.
Frank Legg	Polo, Mo	Return visit	May 20	Sheep	Scabies	Quarantined.

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